Determining Marine Migration Patterns and Behavior of the Gulf Sturgeon in the Gulf Sturgeon Critical Habitat of the Gulf Testing and Training Range and Santa Rosa Island Complex

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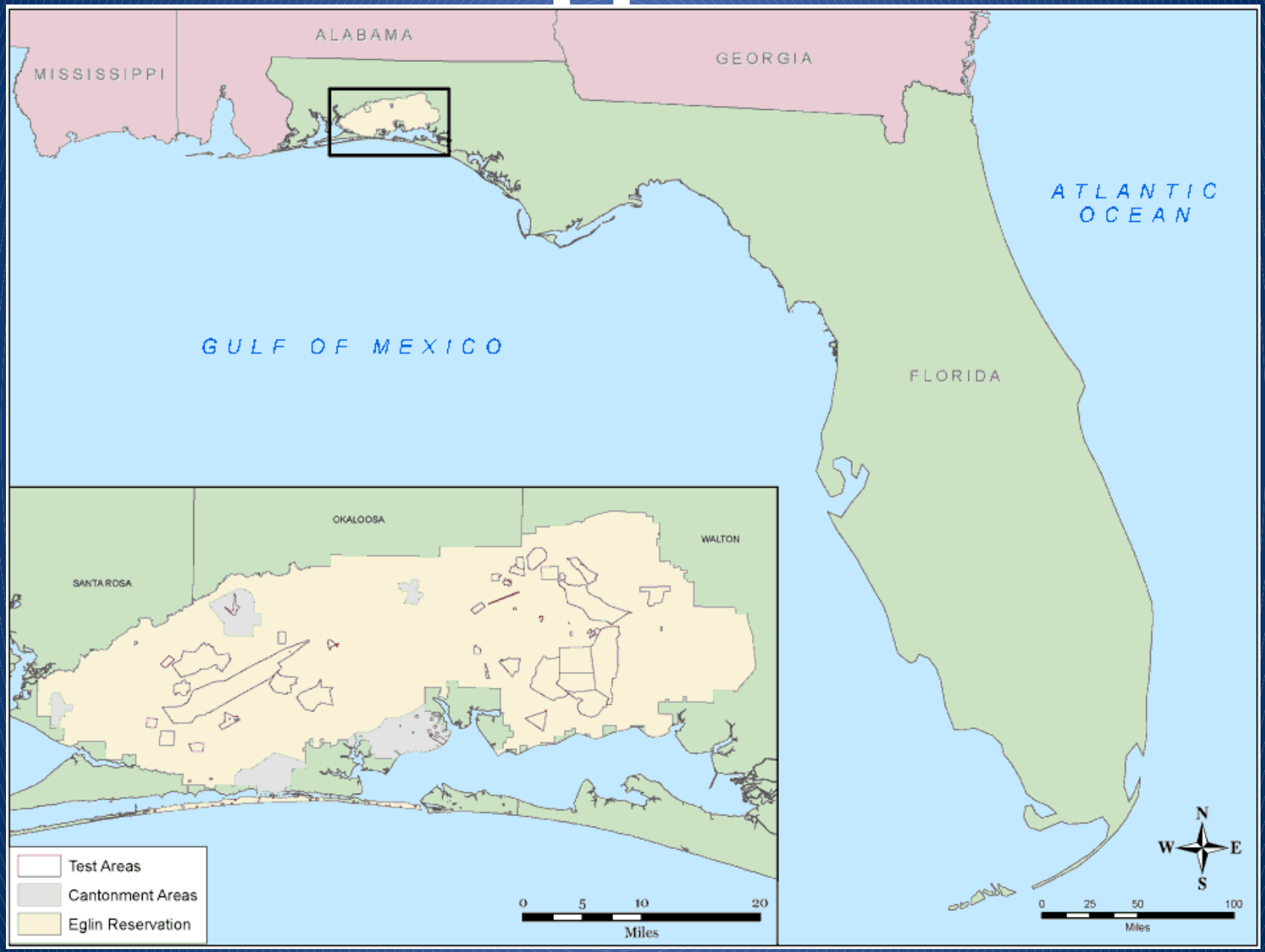
DoD Legacy Resource Management Program

OVERVIEW OF PRESENTATION

- Background information on Eglin AFB
- Eglin's objectives for this study
- History of this research effort
- Summary of Approach
- Summary of Results
  - 2008-2009 Pilot Study
  - 2009-2010 Legacy Study
  - 2010-2011 Legacy Study
  - Combined Legacy Study
- Test Pinger/Range Testing Investigation
- Conclusions
- Acknowledgements

BACKGROUND INFORMATION ON EGLIN AFB

EGLIN AIR FORCE BASE, FL

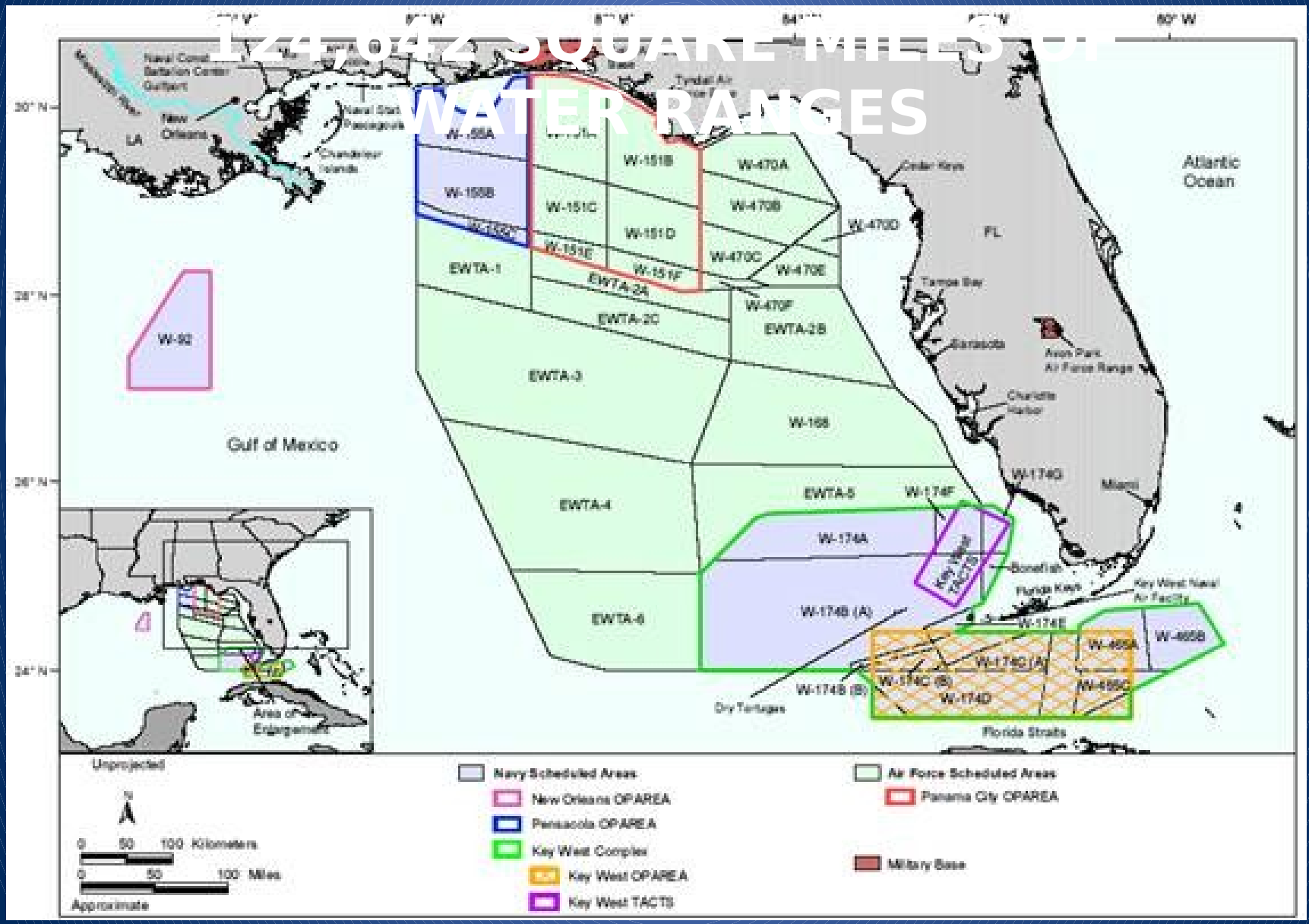


MISSIONS ON EGLIN AFB

- Unique and ideal setting for military testing and training
- Many missions occur within the Eglin Gulf Testing and Training Range (EGTTR) and in the Santa Rosa Island (SRI) Test and Training Range Complex
- Overlaps with Gulf sturgeon critical habitat areas in the Gulf of Mexico

EGLIN GULF TEST AND TRAINING RANGE:

127,000 SQUARE MILES OF WATER RANGES



EGLIN'S OBJECTIVES FOR THIS STUDY

SANTA ROSA ISLAND LOCATION WITHIN GULF STURGEON CRITICAL HABITAT

MISSION IMPACTS TO PROTECTED SPECIES???

- Gulf sturgeon are federally protected under the Endangered Species Act
- Section 7 consultations are required
- Lack of data concerning Gulf sturgeon's usage of areas surrounding Eglin's Gulf ranges
  - Difficult to determine impacts
  - Cannot develop mission avoidance zones or other mitigation measures
- Secured funding from the Department of Defense's Legacy Resource Management Program to conduct this multi-year study

HISTORY OF THIS RESEARCH EFFORT

TIMELINE OF EVENTS

- 2008-2009 Pilot Study
  - Initial effort funded by Eglin Natural Resources Section
  - Received support from U.S. Geological Survey, Florida Fish and Wildlife Conservation Commissions, and U.S. Fish and Wildlife Service
  - Focused on Choctawhatchee River
- 2009 – Received funding from Department of Defense Legacy Resource Management Program to continue the study for 2 more years
  - Purchased additional receivers and tags
  - Modified and expanded Study Area
  - Focused on Yellow, Blackwater, and Escambia Rivers

SUMMARY OF APPROACH

SUMMARY OF APPROACH

- Vemco® V16-5H coded acoustic transmitters were surgically inserted into the abdominal cavity of adult Gulf sturgeon by the USFWS
- 40 Gulf sturgeon from the Choctawhatchee River were tagged for the 2008 Pilot Study
- 40 more Gulf sturgeon from the Yellow, Blackwater, and Escambia Rivers were tagged between August and September 2009
- 40 more Gulf sturgeon tagged in the Yellow, Blackwater, and Escambia Rivers were tagged between August and September 2010
- Over the course of three years, 120 adult Gulf sturgeon were tagged with acoustic transmitters from four different river systems in the area surrounding Eglin Air Force Base (AFB)

SUMMARY OF APPROACH

2008-2009 Pilot Study

- 13 VR2Ws were deployed from October 2008 to April 2009
  - 9 in the Gulf of Mexico
  - 3 in the Santa Rosa Sound
  - 1 in the Choctawhatchee Bay

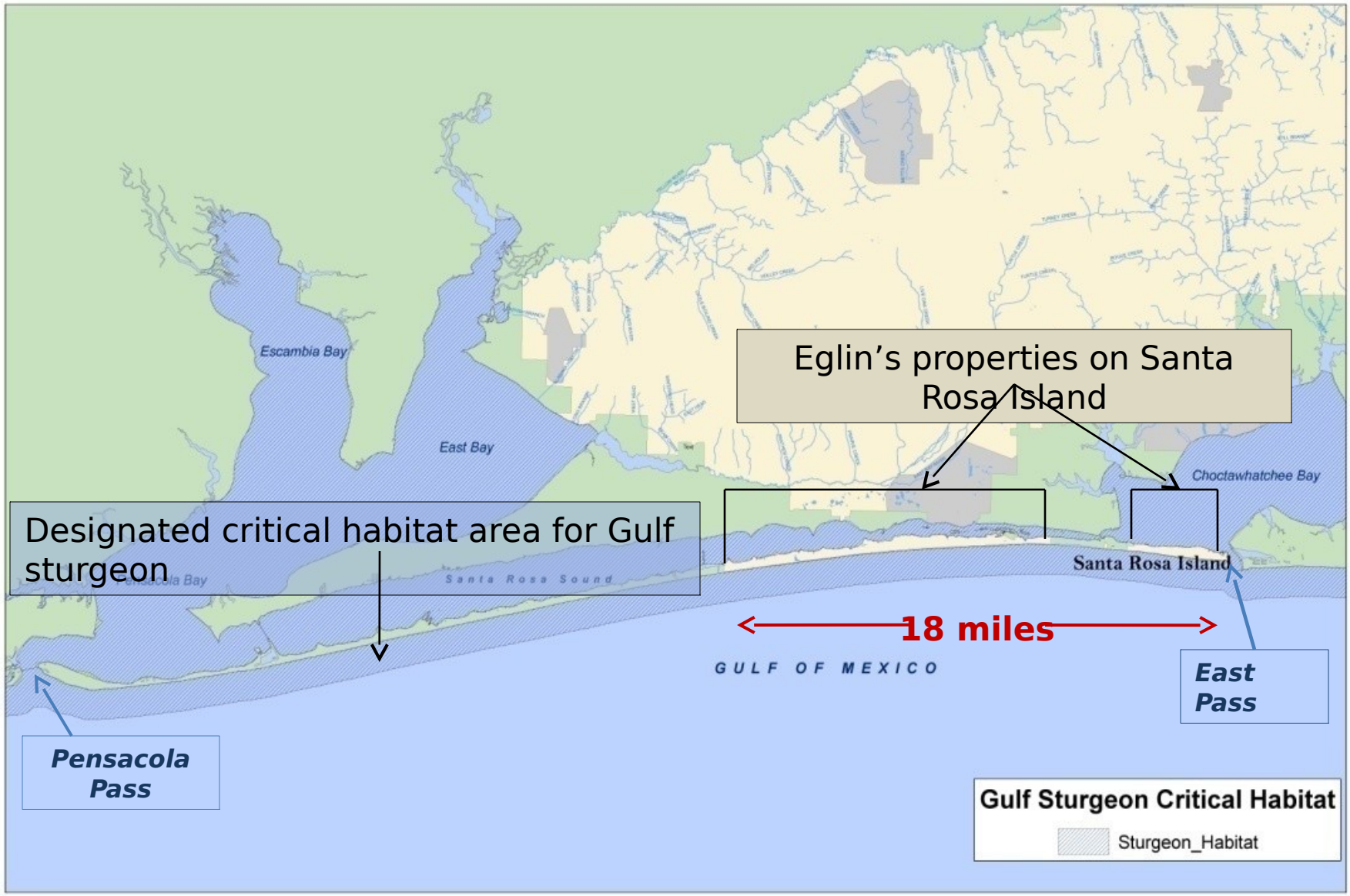
2009-2010 Legacy Study

- 21 VR2Ws were deployed from September 2009 to May 2010
  - 11 in the Gulf of Mexico
  - 4 in the Santa Rosa Sound
  - 2 in the Pensacola Bay
  - 1 in the Yellow River
  - 1 in the Blackwater River
  - 2 in the Escambia River

2010-2011 Legacy Study

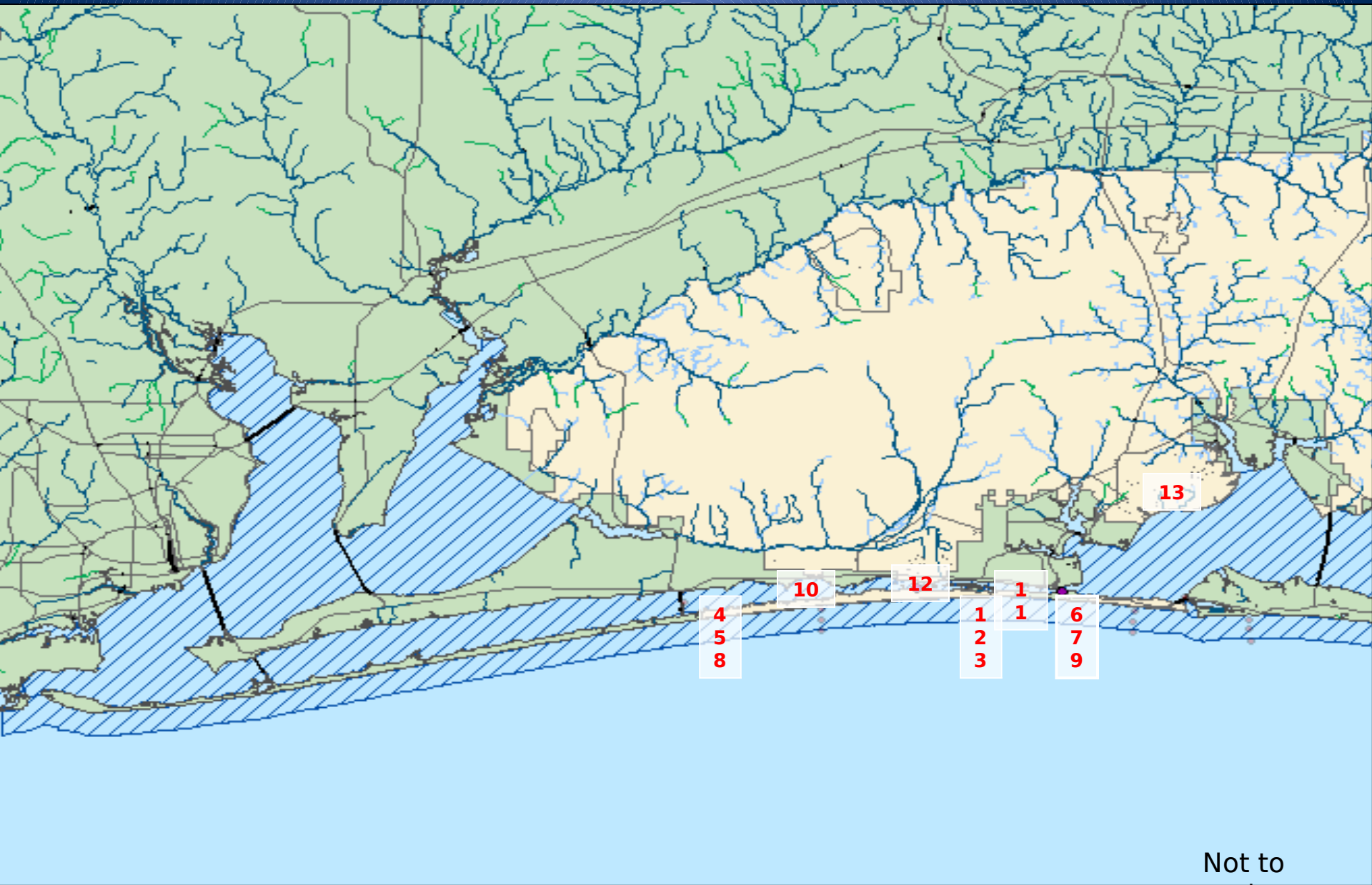
- 17 VR2Ws were deployed from October 2010 to May 2011
  - 11 in the Gulf of Mexico
  - 2 in the Santa Rosa Sound
  - 1 in the Pensacola Bay
  - 1 in the Yellow River
  - 1 in the Blackwater River
  - 1 in the Escambia River

AREA OF INTEREST



SUMMARY OF RESULTS

2008-2009 PILOT STUDY RECEIVER ARRAY

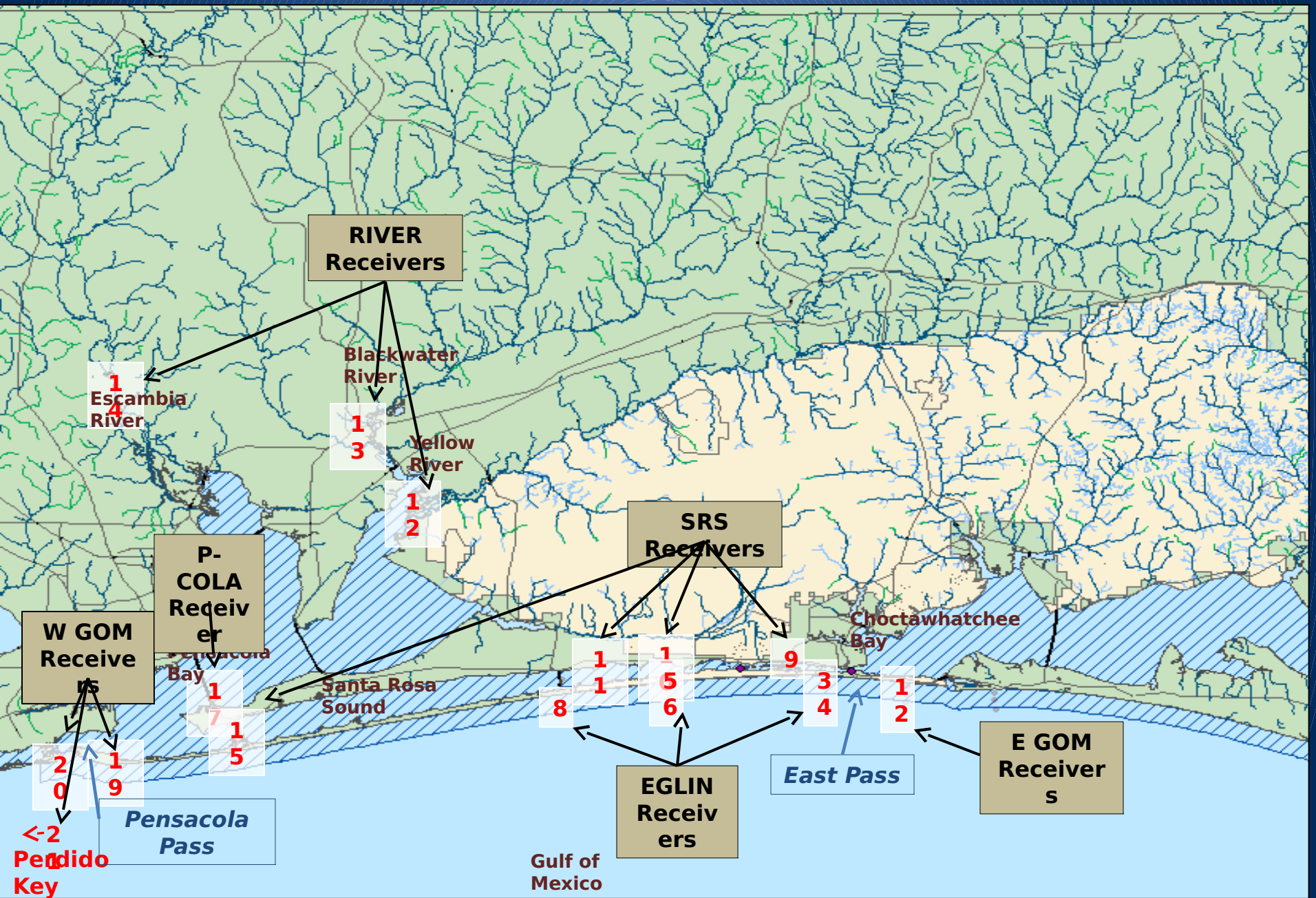


Not to

2008-2009 PILOT STUDY SUMMARY OF RESULTS

- 40 Gulf sturgeon tagged in the Choctawhatchee River
  - Fork lengths ranged from 138-196 cm (54-77 in)
  - Weight ranged from 21-64 kg (46-141 lbs)
- 26 of 40 tagged sturgeon were detected
- 82 % of detections occurred on receivers deployed 500 m from the shore
- 99 % of detections occurred within 1,000 m from shore

2009-2010 LEGACY STUDY RECEIVER ARRAY



2009-2010 LEGACY STUDY SUMMARY OF RESULTS

Tagging Results

- 40 sturgeon tagged in the Yellow, Blackwater, and Escambia Rivers
  - 12 from the Yellow River
  - 25 from the Blackwater River
  - 3 from the Escambia River
- Fork lengths ranged from 123-189 cm (48-74 in)
- Weight ranged from 14-63 kg (31-139 lbs)

2009-2010 LEGACY STUDY SUMMARY OF RESULTS

Detection Results

- 161,569 detections from 86 tagged sturgeon

ASSOCIATED STUDY	LOCATION TAGGED	# OF STURGEON DETECTED	# OF DETECTIONS
Eglin 2009-2010 Legacy Study	Yellow, Blackwater, and Escambia Rivers	**39**	**64,683**
Eglin 2008-2009 Pilot Study	Choctawhatchee River	**14**	**19,832**
Delaware State University	Choctawhatchee River	**30**	**76,787**
National Oceanic & Atmospheric Administration (NOAA)[2]	Escambia River	**3**	**267**

- 80 % of detections occurred within 1,000 m from shore

2009-2010 LEGACY STUDY SUMMARY OF RESULTS

Movement Patterns

Detected 39 sturgeon tagged in Yellow, Blackwater, and Escambia Rivers

PENSACOLA PASS/ PERDIDO KEY RECEIVERS

- 31 of 39 headed west once they entered the GOM

EGLIN/SRI/EAST PASS RECEIVERS

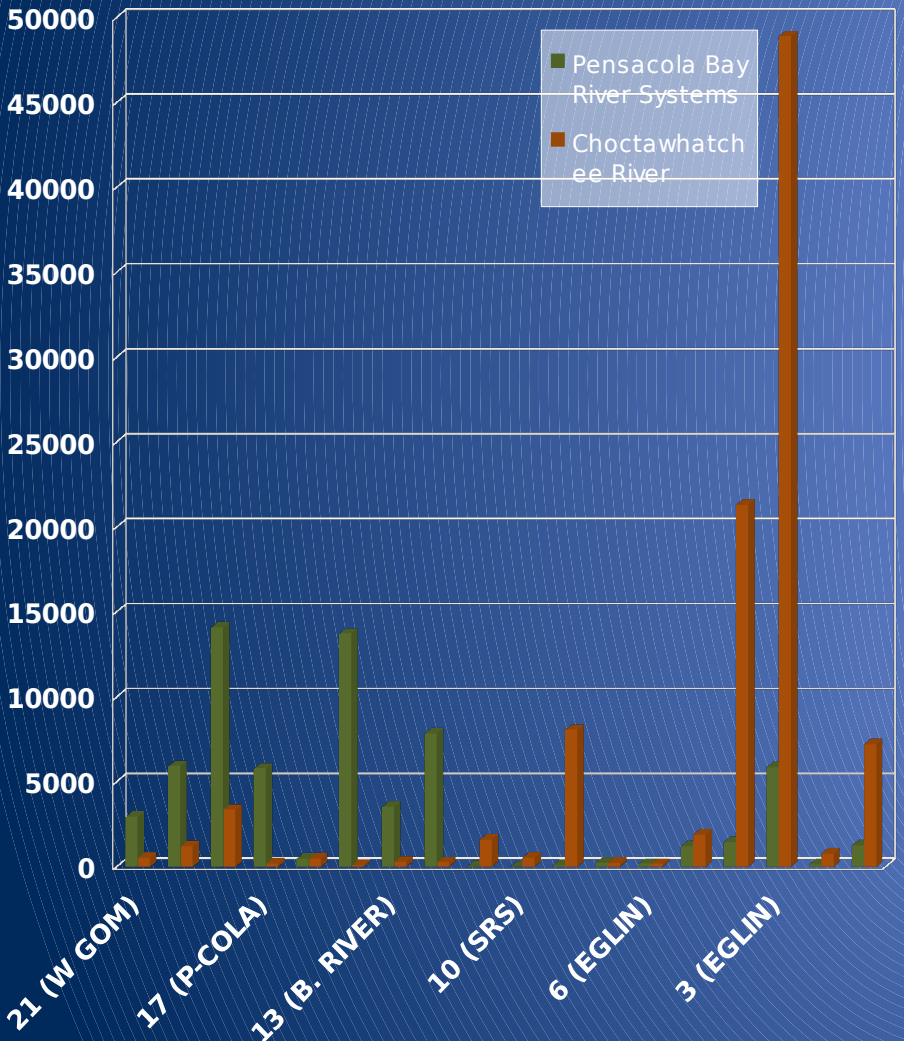
- 8 of 39 headed east once they entered the GOM

79% headed west

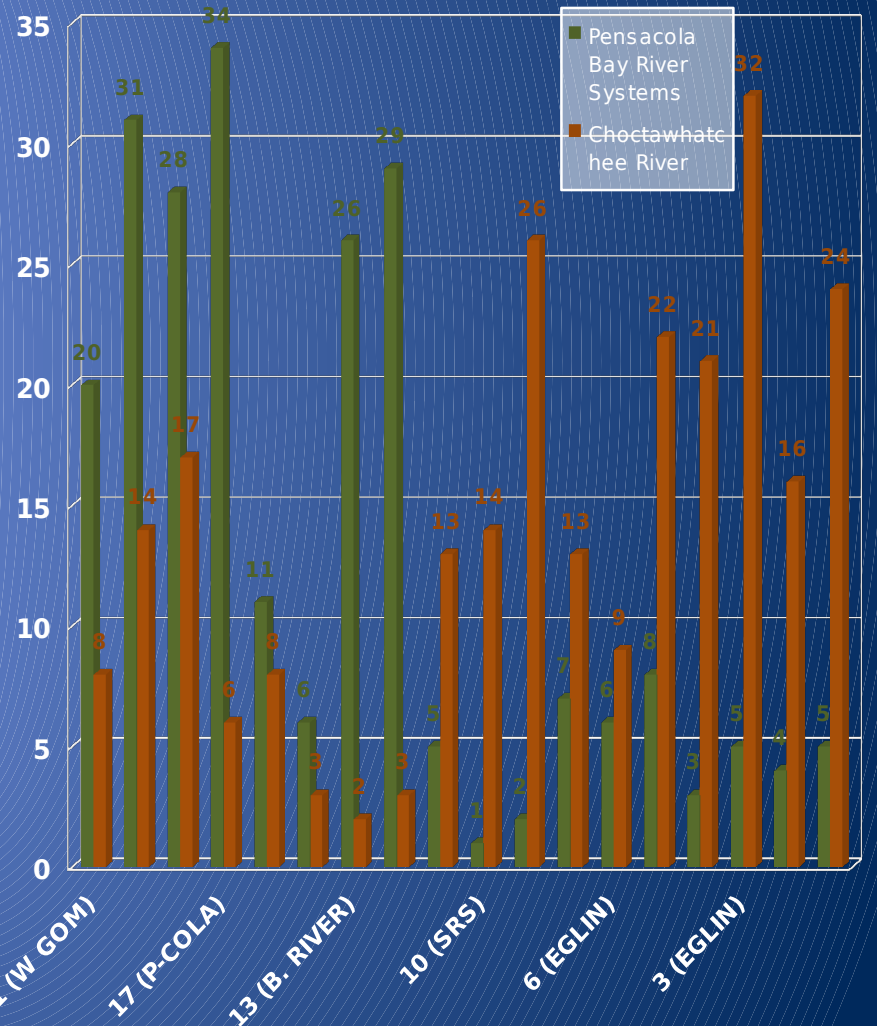
21 % headed east

2009-2010 LEGACY STUDY SUMMARY OF RESULTS

Number of Detections per Receiver



Number of Sturgeon Detected per Receiver

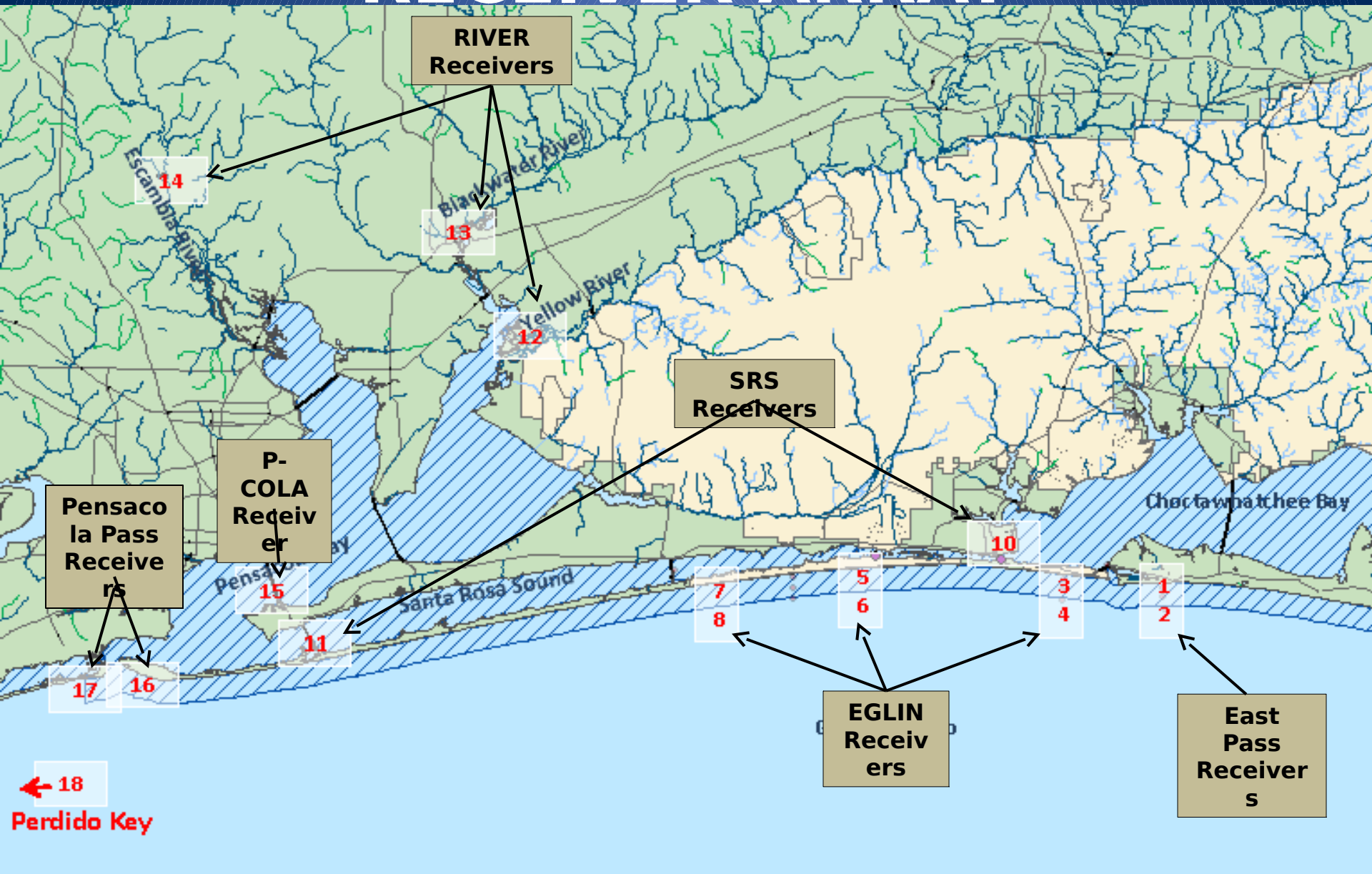


2009-2010 LEGACY STUDY SUMMARY OF RESULTS

River Fidelity

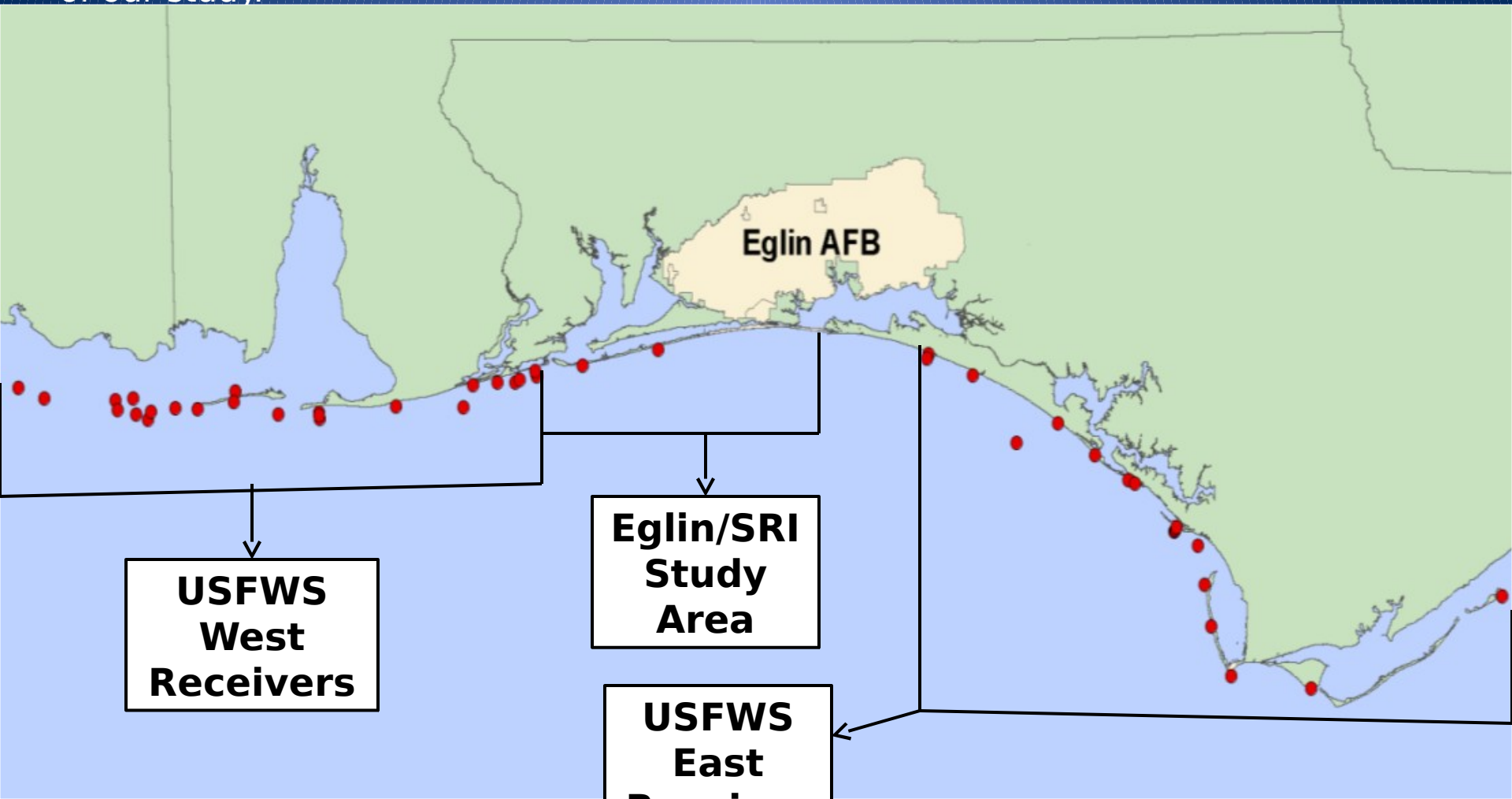
- Of the 39 sturgeon tagged in 2009 and detected during the 2009-2010 Legacy Study only 22 returned to the same river where they were originally tagged
- 17 sturgeon (44%) were detected in rivers where they were not originally tagged

2010-2011 LEGACY STUDY RECEIVER ARRAY



ADDITIONAL ARRAY DEPLOYED IN 2010

In 2010, a separate telemetry array was deployed in the Gulf of Mexico by the USFWS, which consisted of 135 VR2W receivers that stretched from Lake Pontchartrain, Louisiana to Cedar Key, Florida. The locations of the receivers in this extensive array were provided to us as well as any detection data from Gulf sturgeon tagged as part of our study.



2010-2011 LEGACY STUDY SUMMARY OF RESULTS

Tagging Results

- 40 more sturgeon tagged in the Yellow, Blackwater, and Escambia Rivers
  - 14 from the Yellow River (26 total)
  - 11 from the Blackwater River (36 total)
  - 15 from the Escambia River (18 total)
- Fork lengths ranged from 116-191 cm (46-75 in)
- Weight ranged from 14-62 kg (31-137 lbs)

2010-2011 LEGACY STUDY SUMMARY OF RESULTS

Detection Results

- 422,340 detections from 126 tagged sturgeon

ASSOCIATED STUDY	LOCATION TAGGED	# OF STURGEON DETECTED	# OF DETECTIONS
Eglin 2010-2011 Legacy Study	Yellow, Blackwater, and Escambia Rivers	**39**	**87,002**
Eglin 2009-2010 Legacy Study	Yellow, Blackwater, and Escambia Rivers	**38**	**35,535**
Eglin 2008-2009 Pilot Study	Choctawhatchee River	**9**	**13,368**
Delaware State University	Choctawhatchee River	**40**	**286,435**

ore shore

- 62% of detections occurred outside 1,000 m from shore

2010-2011 LEGACY STUDY SUMMARY OF RESULTS

Movement Patterns

Detected 75 sturgeon tagged in Yellow, Blackwater, and Escambia Rivers

PENSACOLA PASS/ PERDIDO KEY RECEIVERS

- 66 of 75 headed west once they entered the GOM

EGLIN/SRI/EAST PASS RECEIVERS

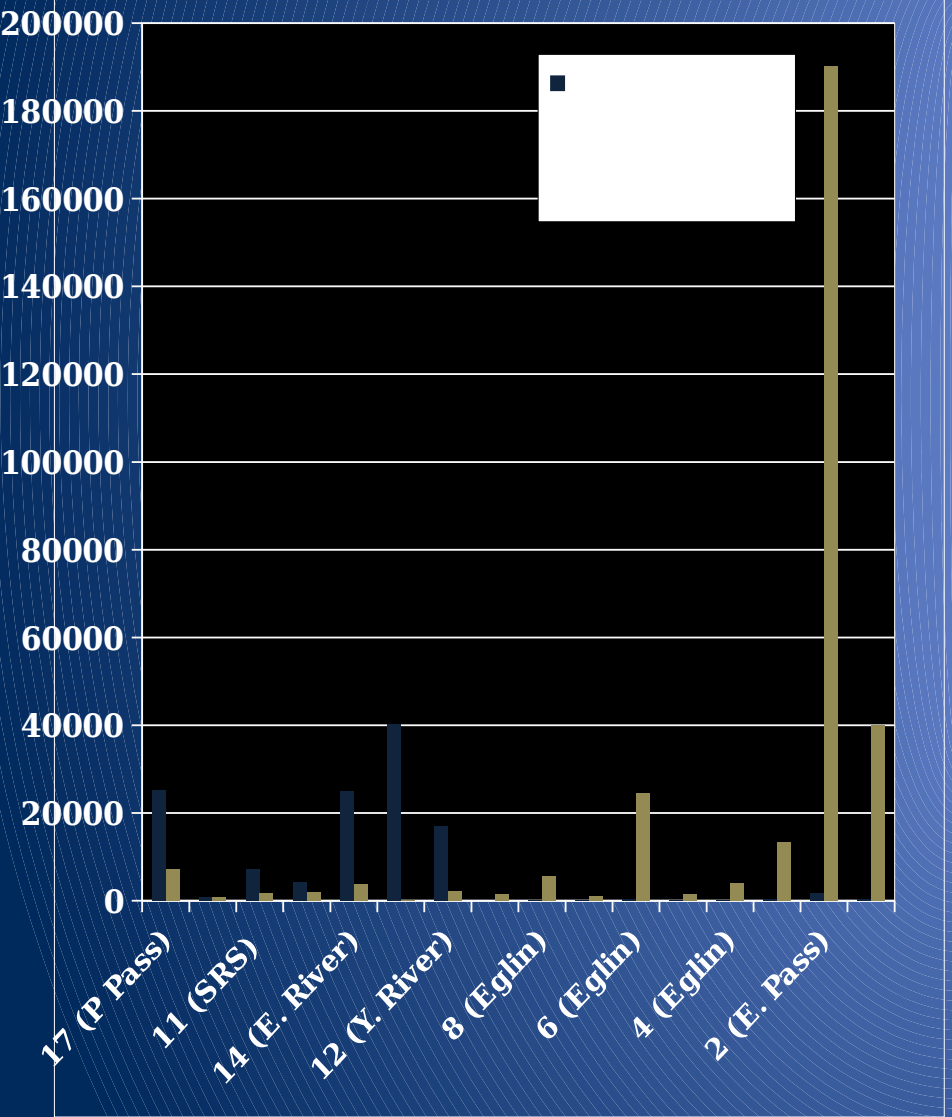
- 9 of 75 headed east once they entered the GOM

88% headed west

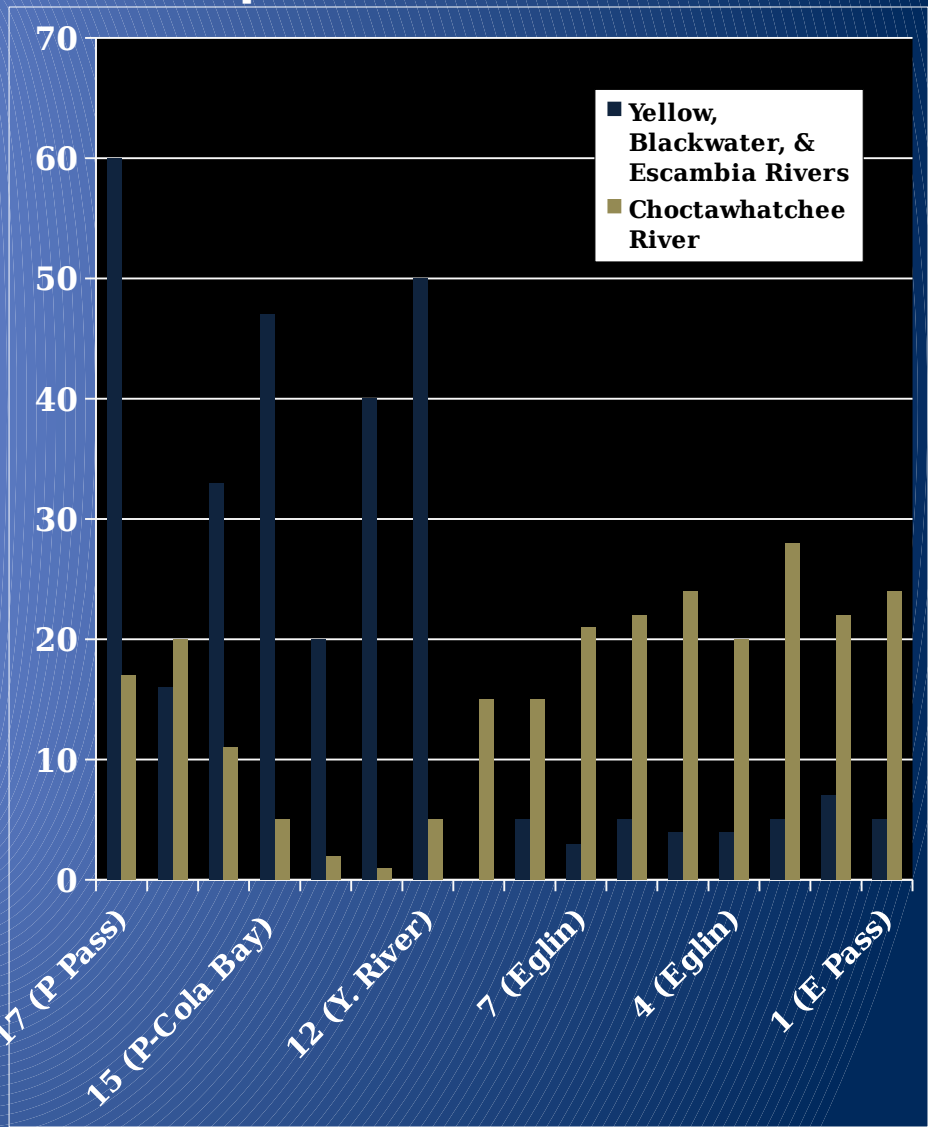
12 % headed east

2010-2011 LEGACY STUDY SUMMARY OF RESULTS

Number of Detections per Receiver



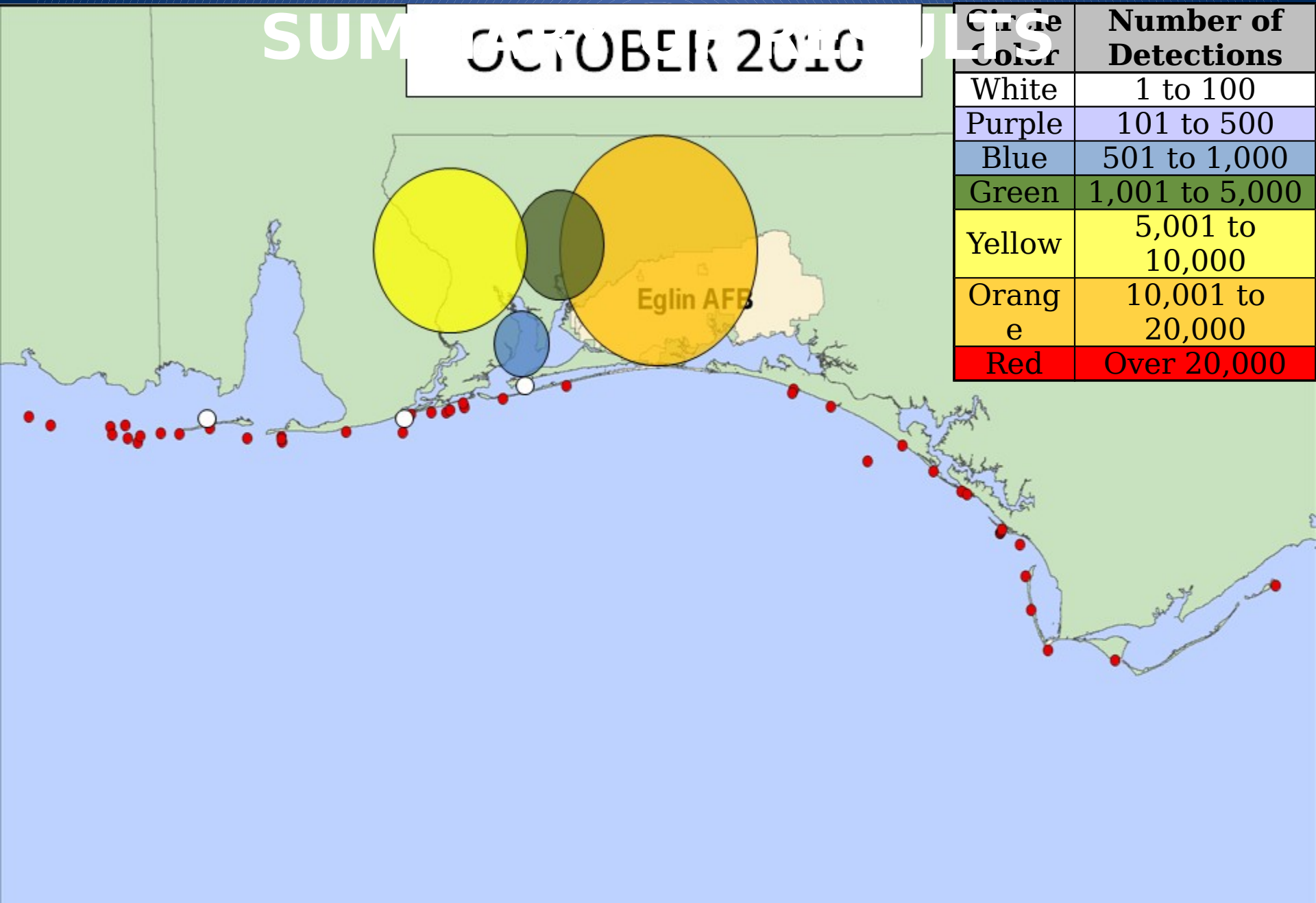
Number of Sturgeon Detected per Receiver



2010-2011 LEGACY STUDY

SUM[illegible]ULTS

OCTOBER 2010

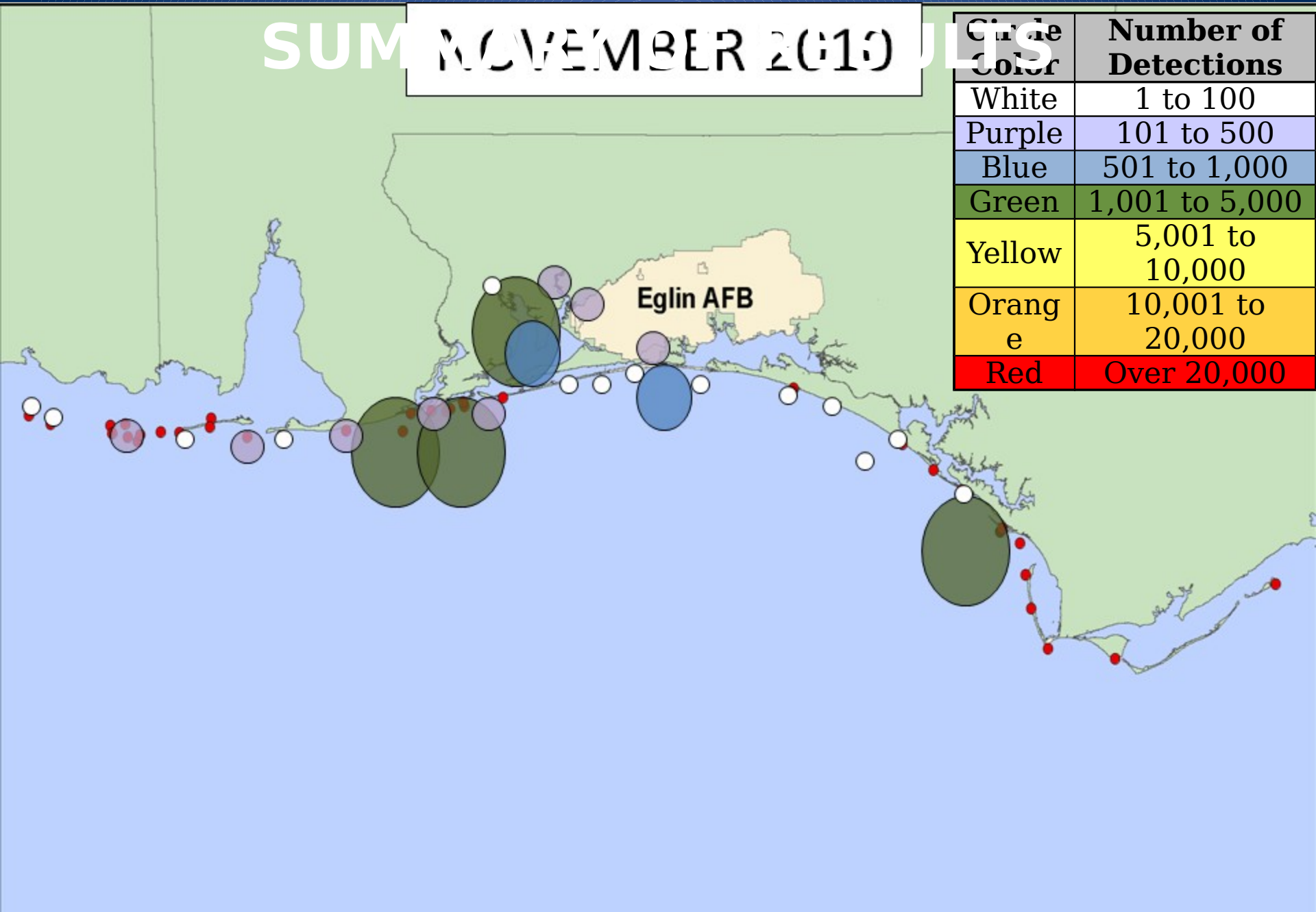


Circle Color	Number of Detections
White	1 to 100
Purple	101 to 500
Blue	501 to 1,000
Green	1,001 to 5,000
Yellow	5,001 to 10,000
Orange	10,001 to 20,000
Red	Over 20,000

2010-2011 LEGACY STUDY

SUM[illegible] RESULTS

NOVEMBER 2010



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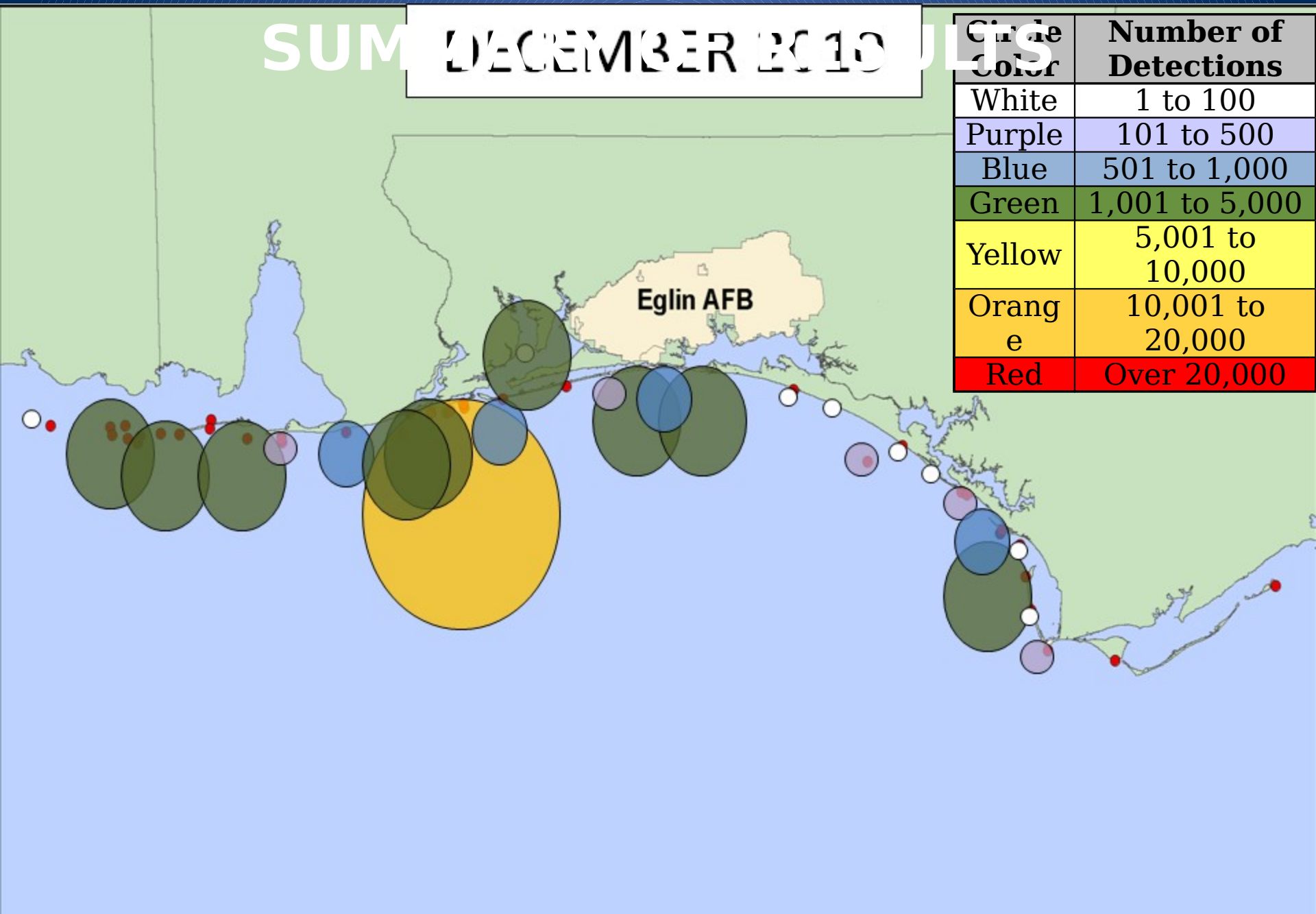
Green	1,001 to 5,000
Yellow	5,001 to 10,000
Orange	10,001 to 20,000
Red	Over 20,000

2010-2011 LEGACY STUDY

SUMMARY RESULTS

DECEMBER 2010



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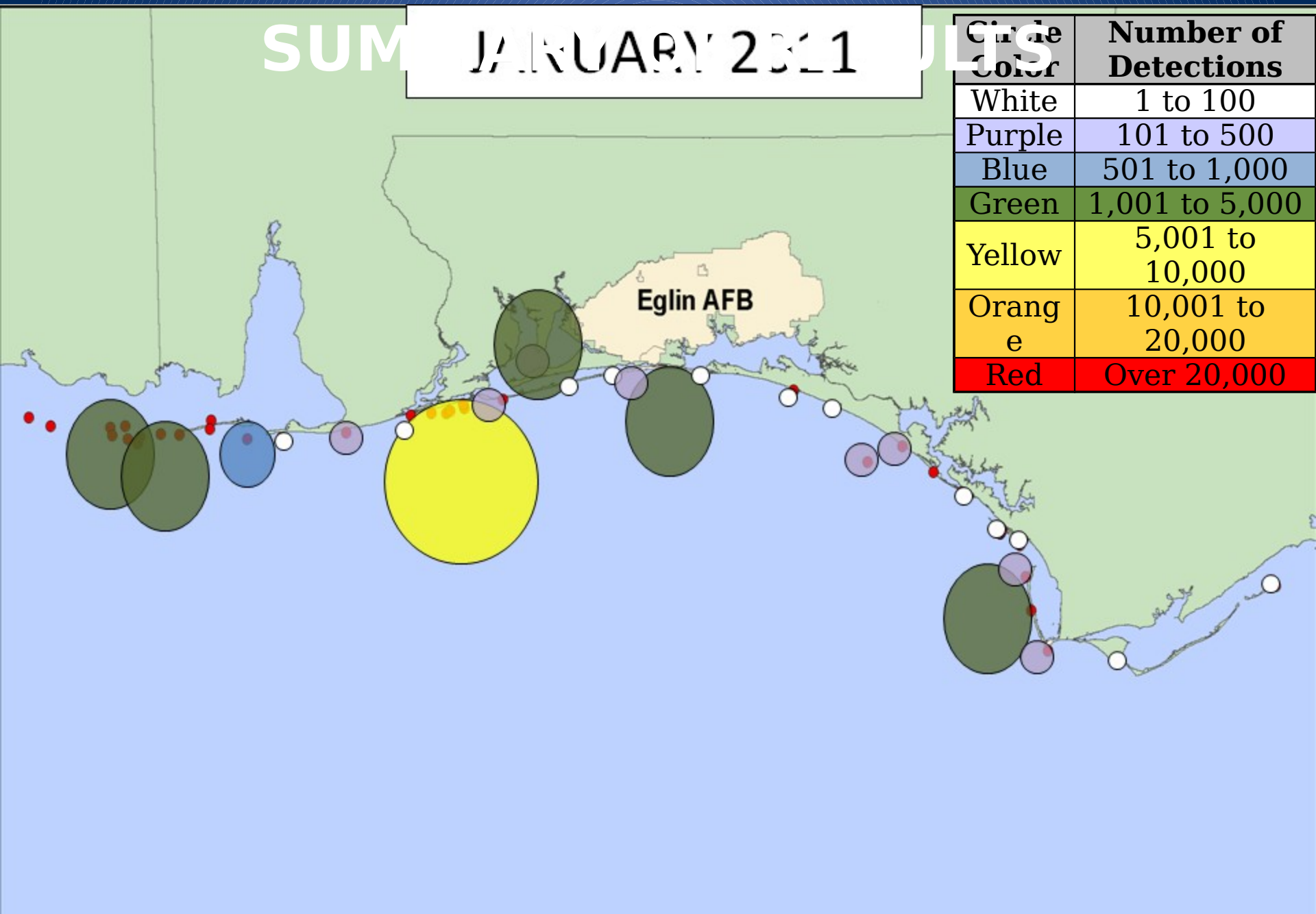
2010-2011 LEGACY STUDY

SUMMARY RESULTS



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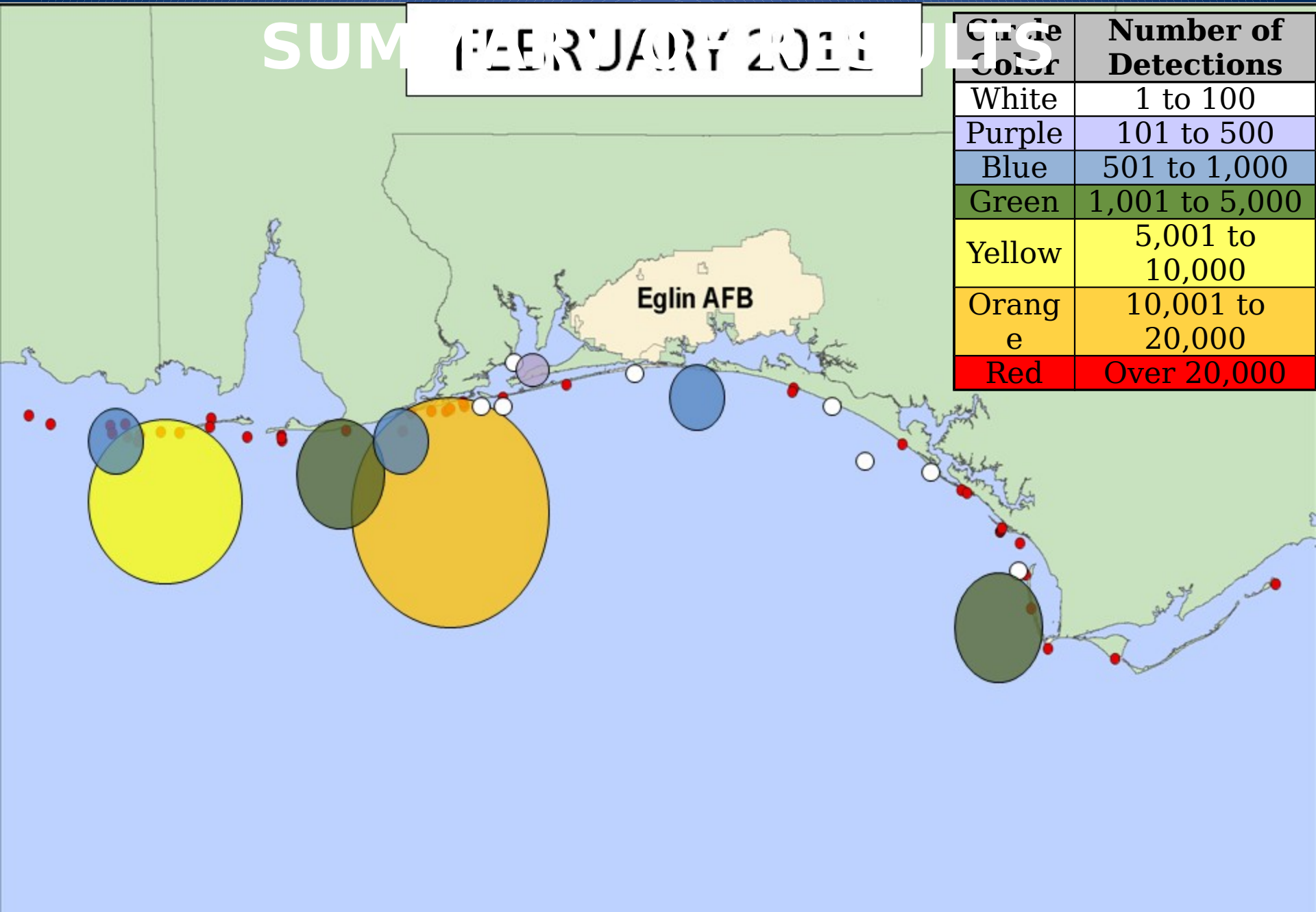
2010-2011 LEGACY STUDY

SUMMARY RESULTS

FEBRUARY 2011



Circle Color	Number of Detections
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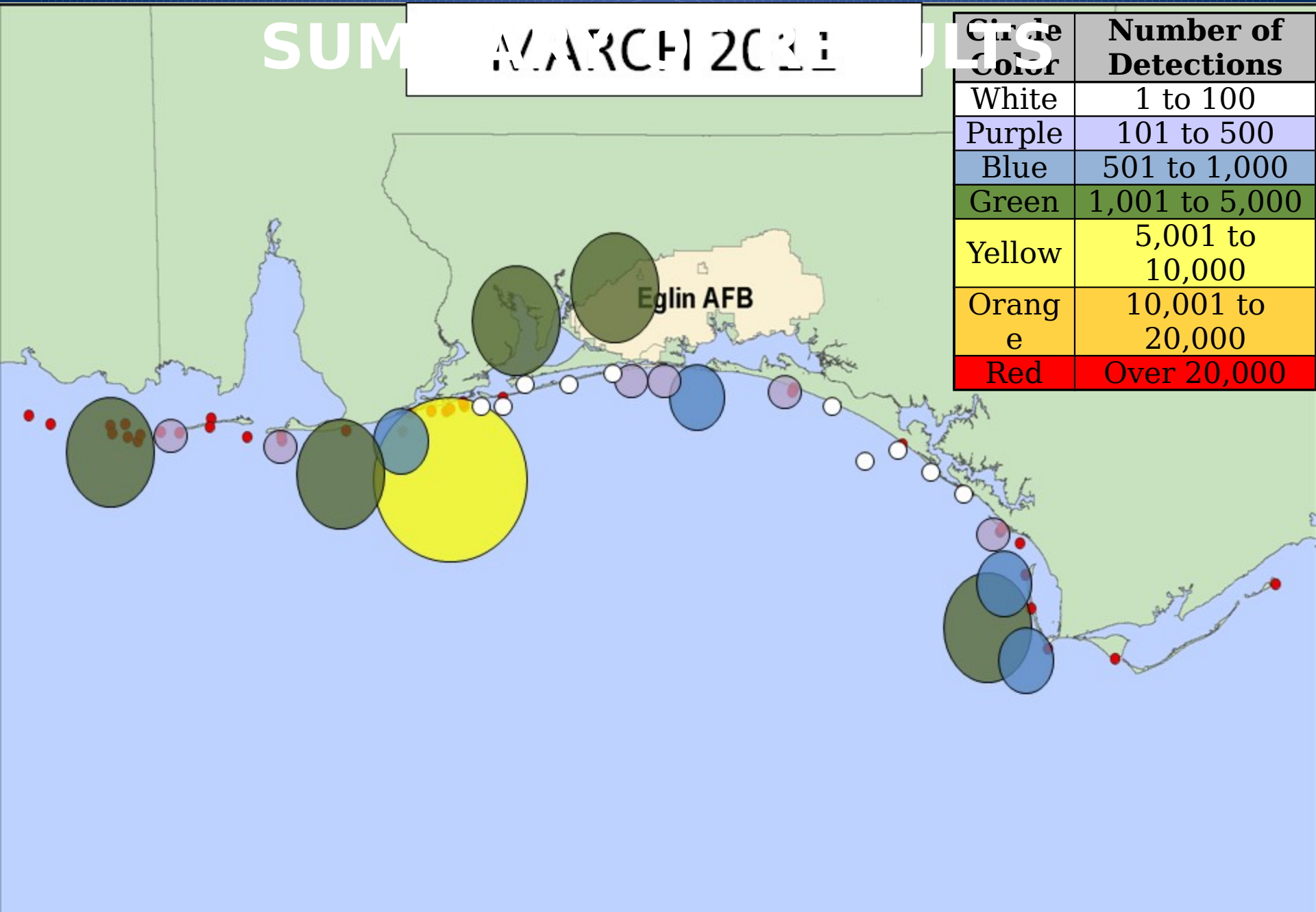
Yellow	5,001 to 10,000
Orange	10,001 to 20,000
Red	Over 20,000

2010-2011 LEGACY STUDY

SUM[illegible]ULTS

MARCH 2011



Circle Color	Number of Detections
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Blue	501 to 1,000
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Yellow	5,001 to 10,000
Orange	10,001 to 20,000
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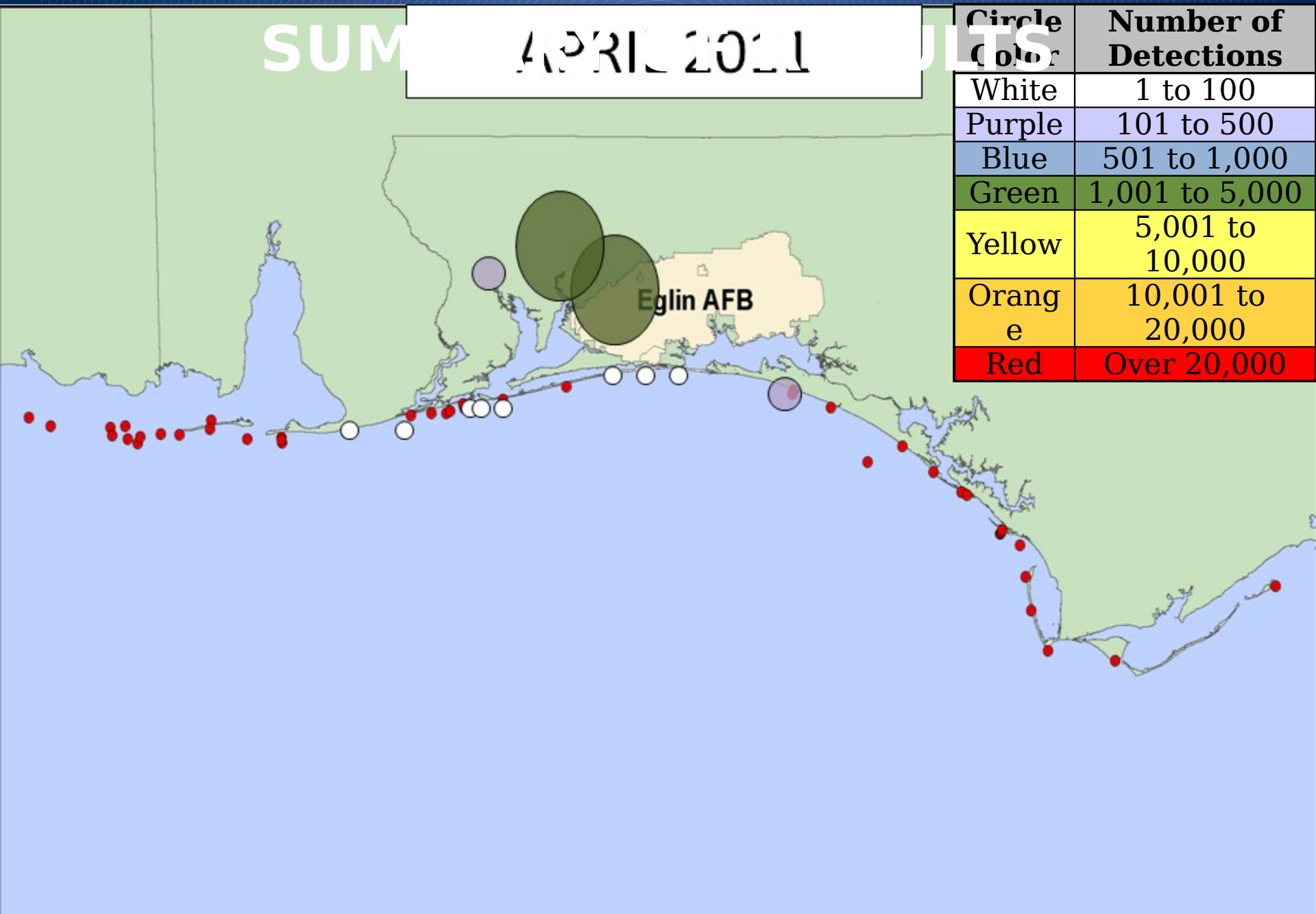
2010-2011 LEGACY STUDY

SUM ULTS



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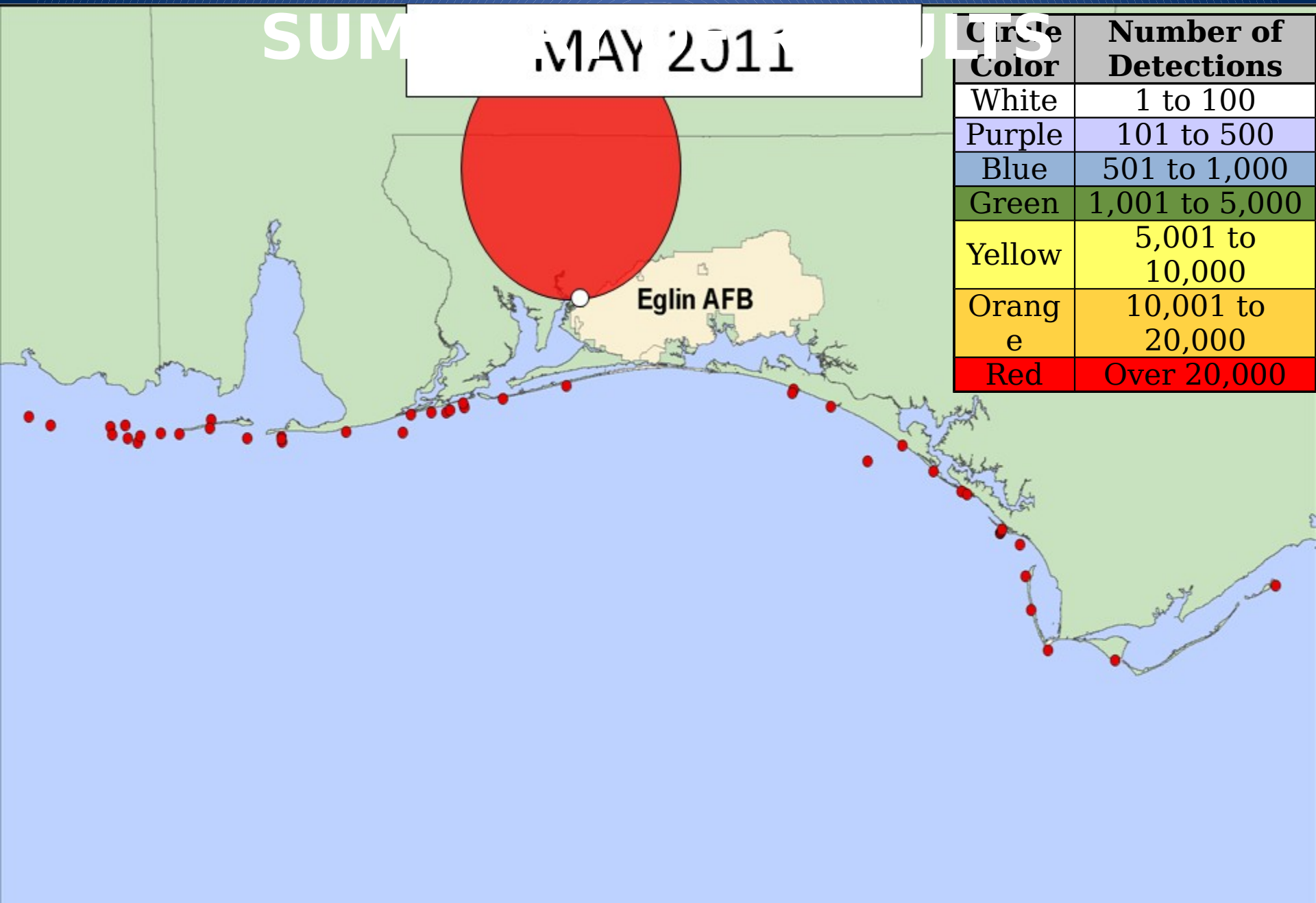
2010-2011 LEGACY STUDY

SUM[illegible]ULTS



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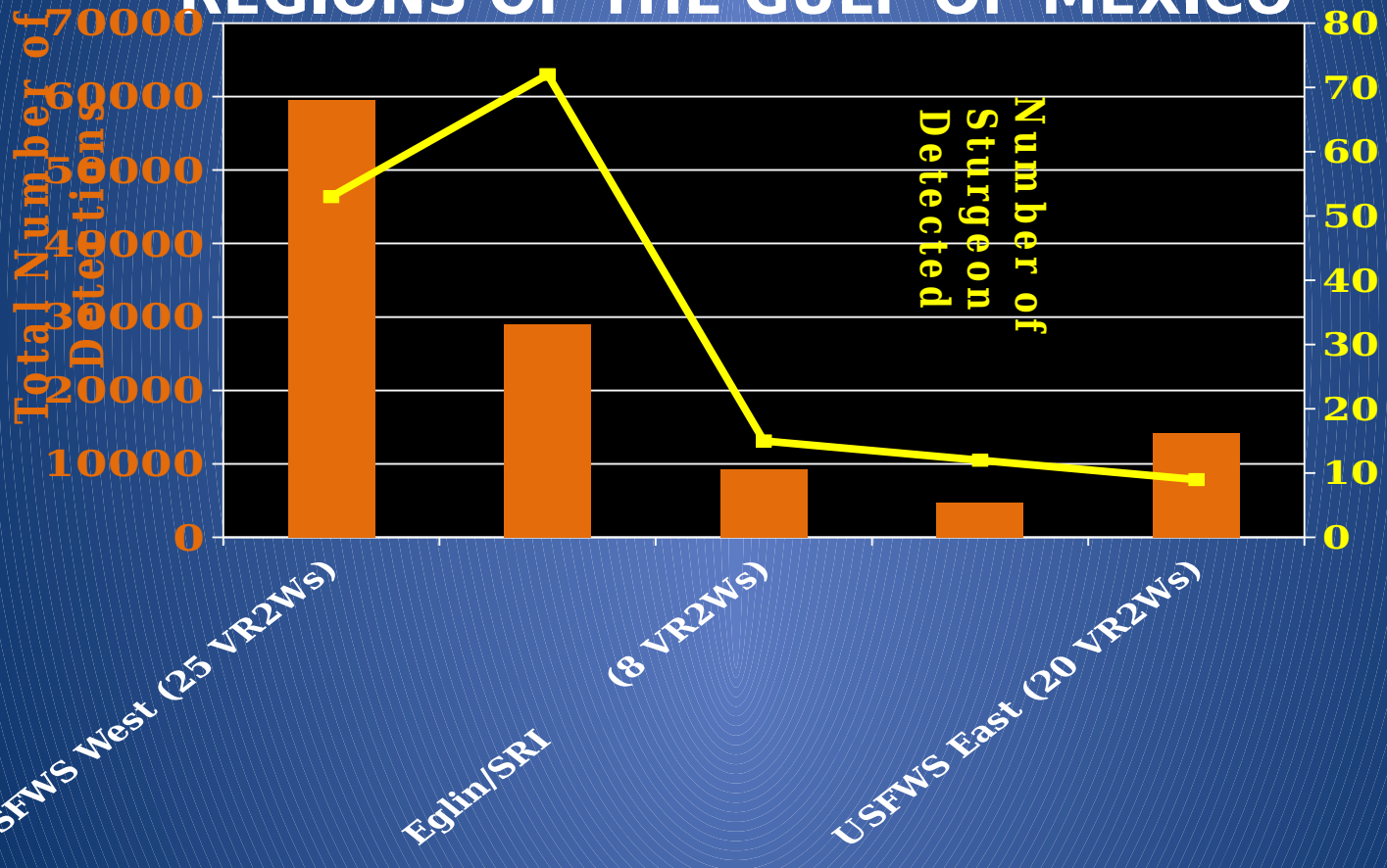
Green	1,001 to 5,000
Yellow	5,001 to 10,000
Orange	10,001 to 20,000
Red	Over 20,000

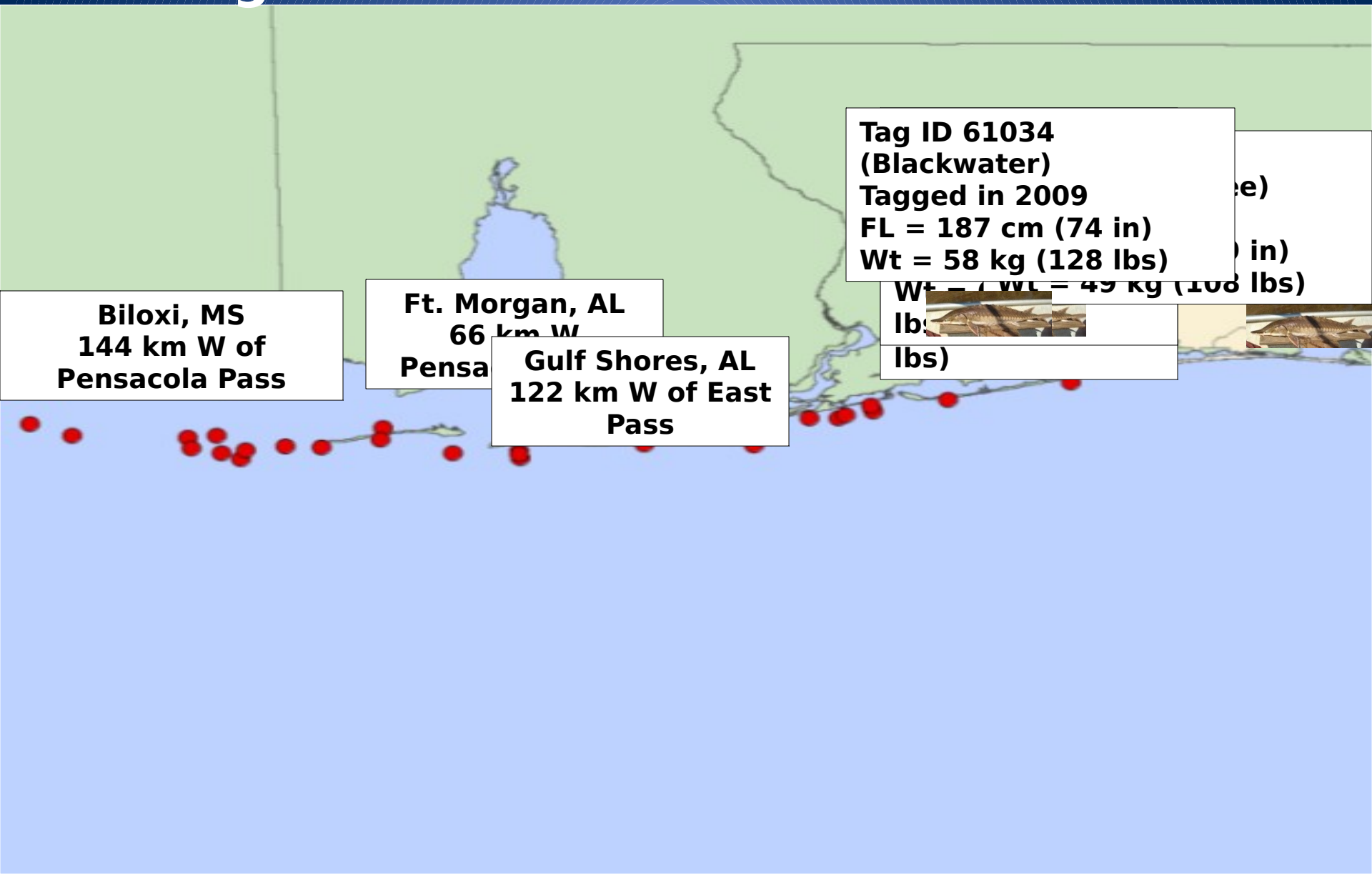
2010-2011 LEGACY STUDY SUMMARY OF RESULTS

TOTAL NUMBER OF DETECTIONS AND STURGEON DETECTED ON RECEIVERS DEPLOYED IN VARIOUS REGIONS OF THE GULF OF MEXICO



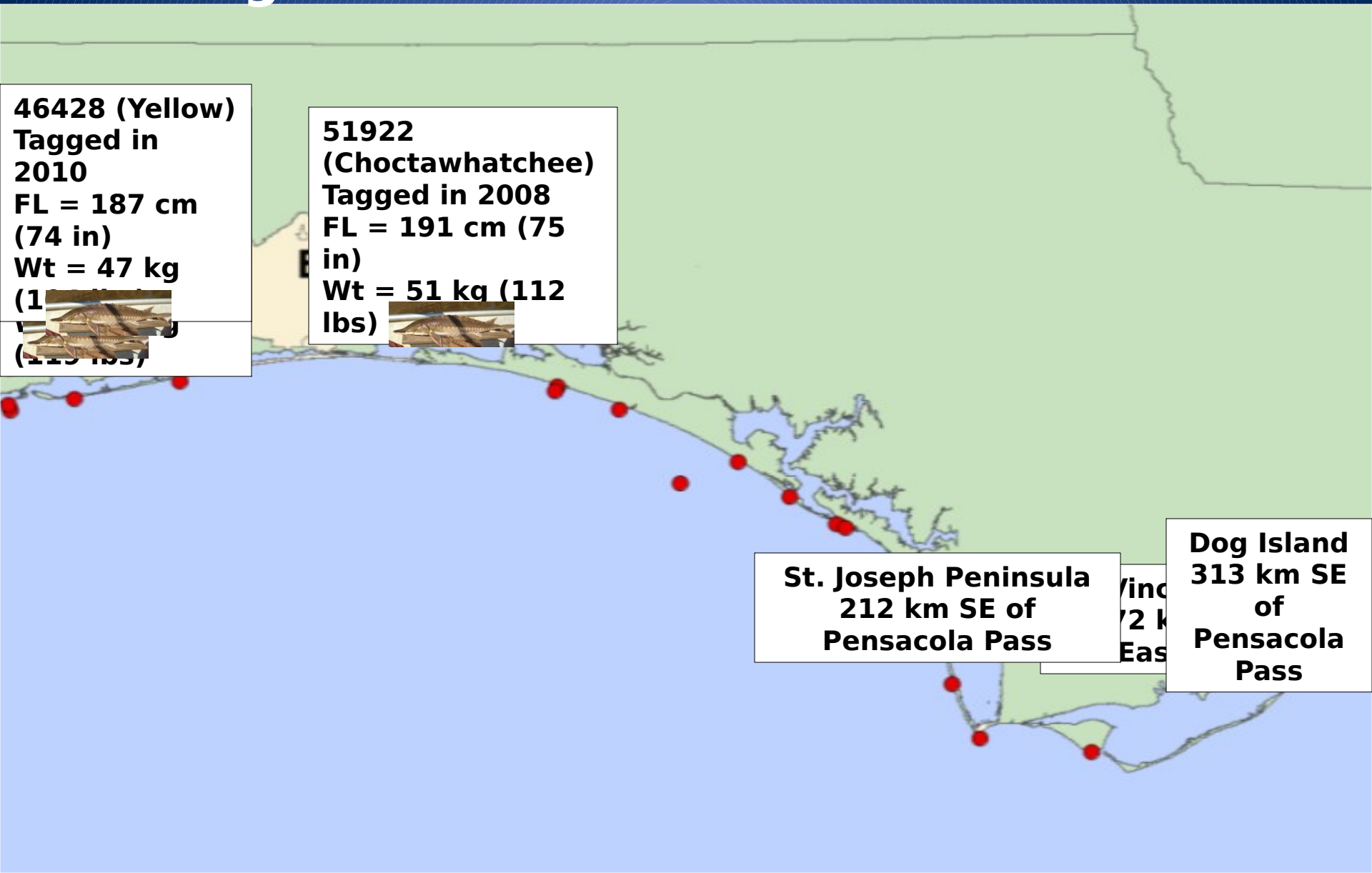
2010-2011 LEGACY STUDY SUMMARY OF RESULTS

Range of Movements: Western Extent



2010-2011 LEGACY STUDY SUMMARY OF RESULTS

Range of Movements: Eastern Extent


46428 (Yellow)
Tagged in 2010
FL = 187 cm (74 in)
Wt = 47 kg (1
(119 lbs)
51922 (Choctawhatchee)
Tagged in 2008
FL = 191 cm (75 in)
Wt = 51 kg (112 lbs)
St. Joseph Peninsula
212 km SE of Pensacola Pass
Dog Island
313 km SE of Pensacola Pass

2010-2011 LEGACY STUDY SUMMARY OF RESULTS

River Fidelity

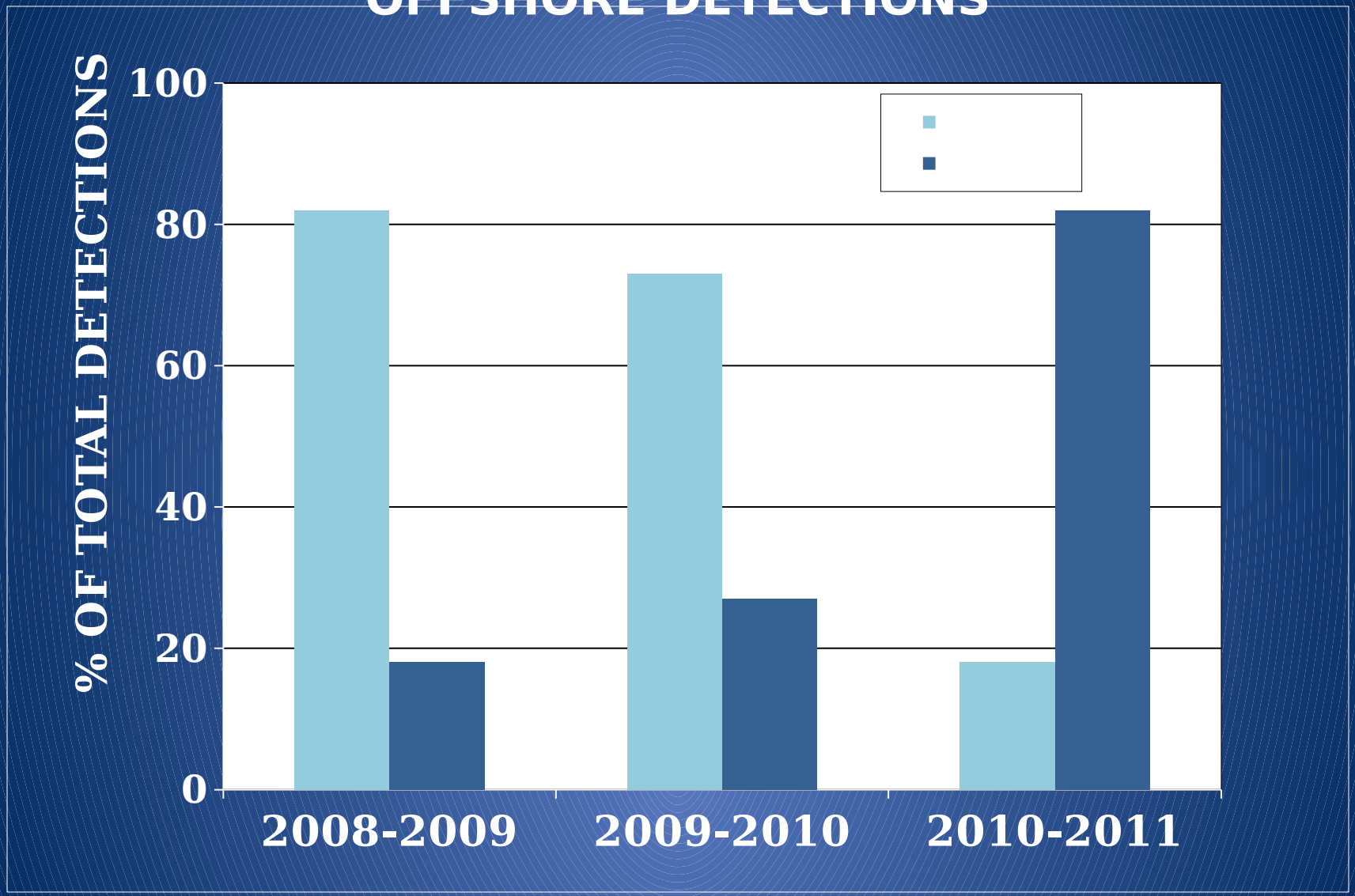
- Of the 77 sturgeon tagged in 2009 and 2010 that were detected during the 2010-2011 data collection period, only 22 returned to the same river
- 29 sturgeon (38 %) were detected in rivers where they were not originally tagged

COMBINED LEGACY STUDY SUMMARY OF RESULTS

Detection success over 3 years of tagging

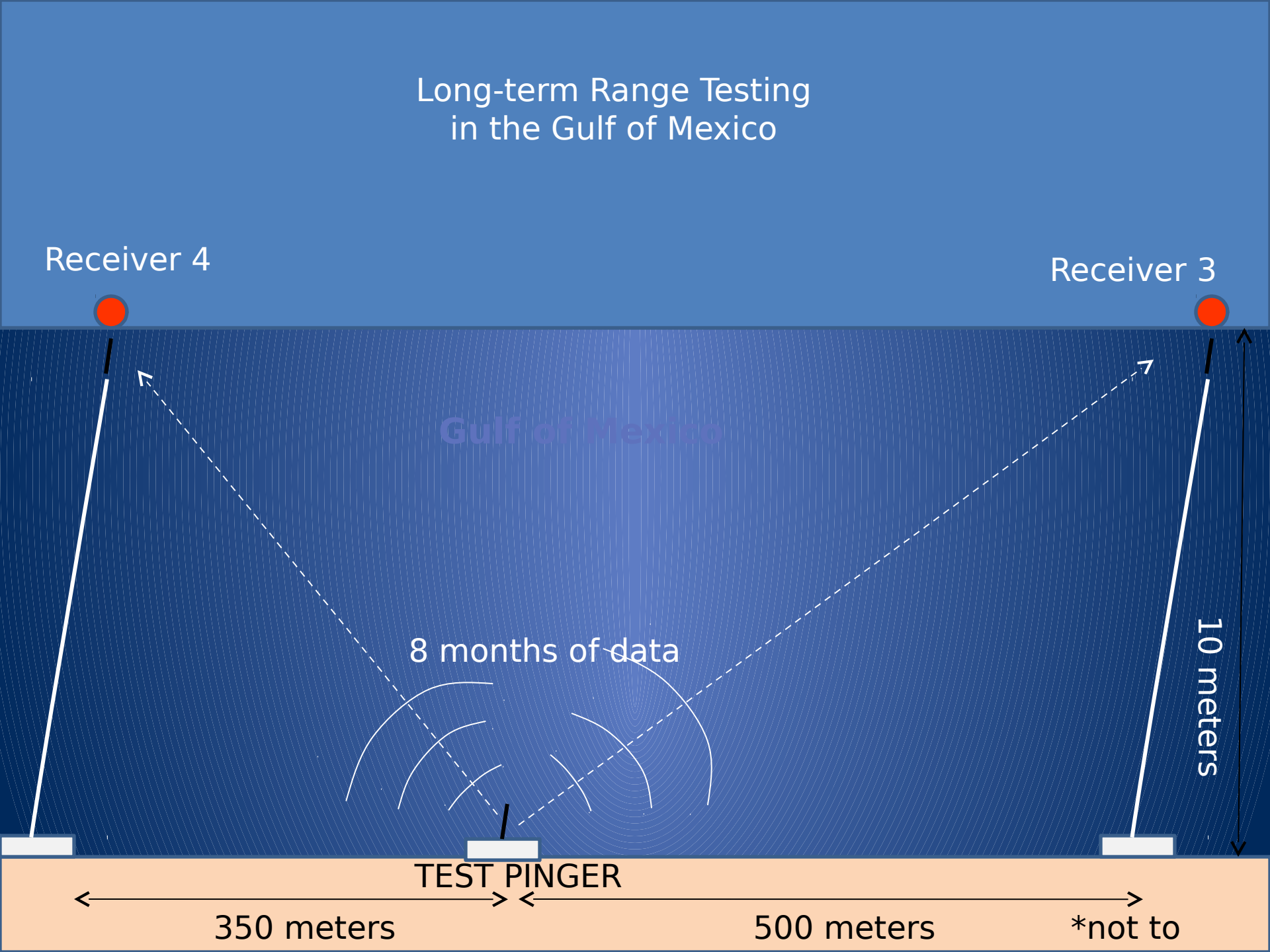
RIVER SOURCE	YEAR TAGGED	# TAGGED	# DETECTED	% SUCCESS
2008-2009 Pilot Study				
Choctawhatchee River	2008	40	26	65%
2008-2009 TOTAL		**40**	**26**	**65%**
2009-2010 Legacy Study				
Choctawhatchee River	2008	40	13	33%
Yellow River	2009	12	12	100%
Blackwater River	2009	25	24	96%
Escambia River	2009	3	3	100%
2009-2010 TOTAL		**80**	**52**	**65%**
2010-2011 Legacy Study				
Choctawhatchee River	2008	40	8	20%
Yellow River	2009	12	11	92%
	2010	14	14	100%
	Total	26	25	96%
Blackwater River	2009	25	24	96%
	2010	11	10	91%
	Total	36	34	94%
Escambia River	2009	3	3	100%
	2010	15	13	87%
	Total	18	16	89%
2010-2011 TOTAL		**120**	**83**	**69%**

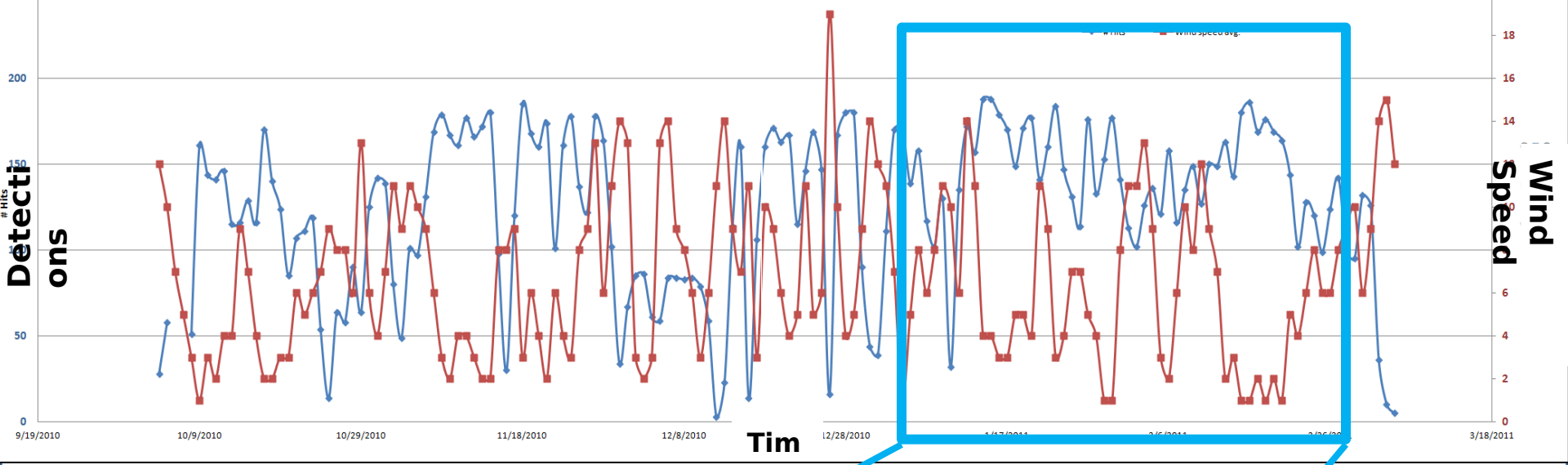
COMPARISON OF % INSHORE DETECTIONS VS. % OFFSHORE DETECTIONS

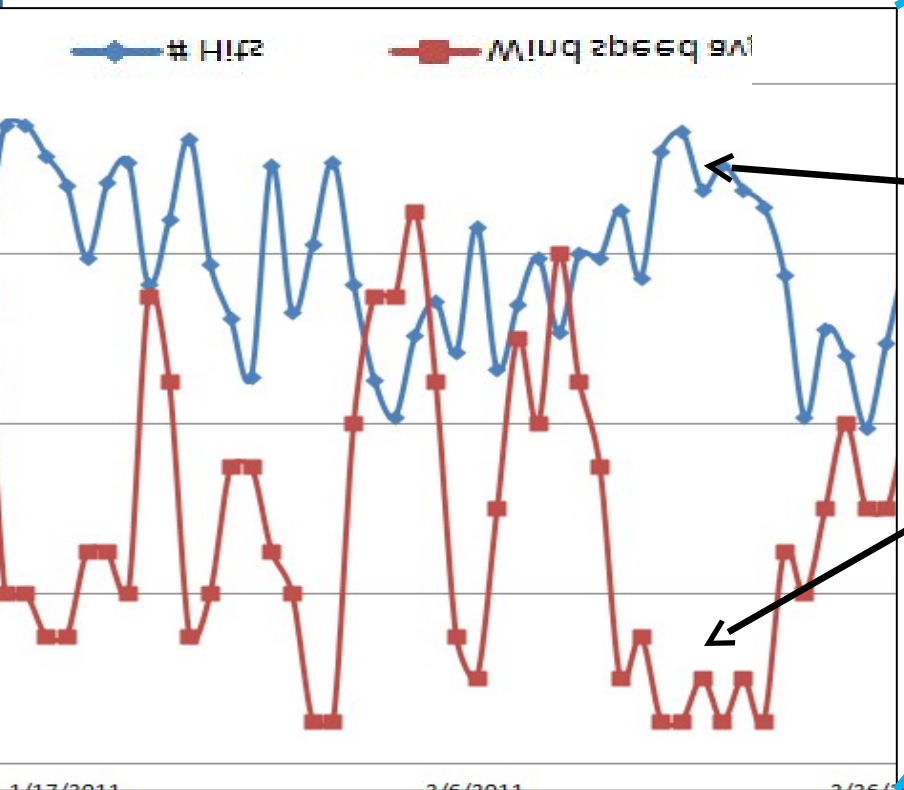


- Inshore receivers deployed between 200 m and 500 m from shore in water depths of 7 m or less
- Offshore receivers deployed between 600 m and 1,300 m from shore in water

Test Pinger/Range Testing Investigation


Long-term Range Testing
in the Gulf of Mexico
Receiver 4
Receiver 3
Gulf of Mexico
8 months of data
10 meters
TEST PINGER
350 meters
500 meters
*not to





Maximum detections received this day.

Associated wind speed for this day

RESULTS:

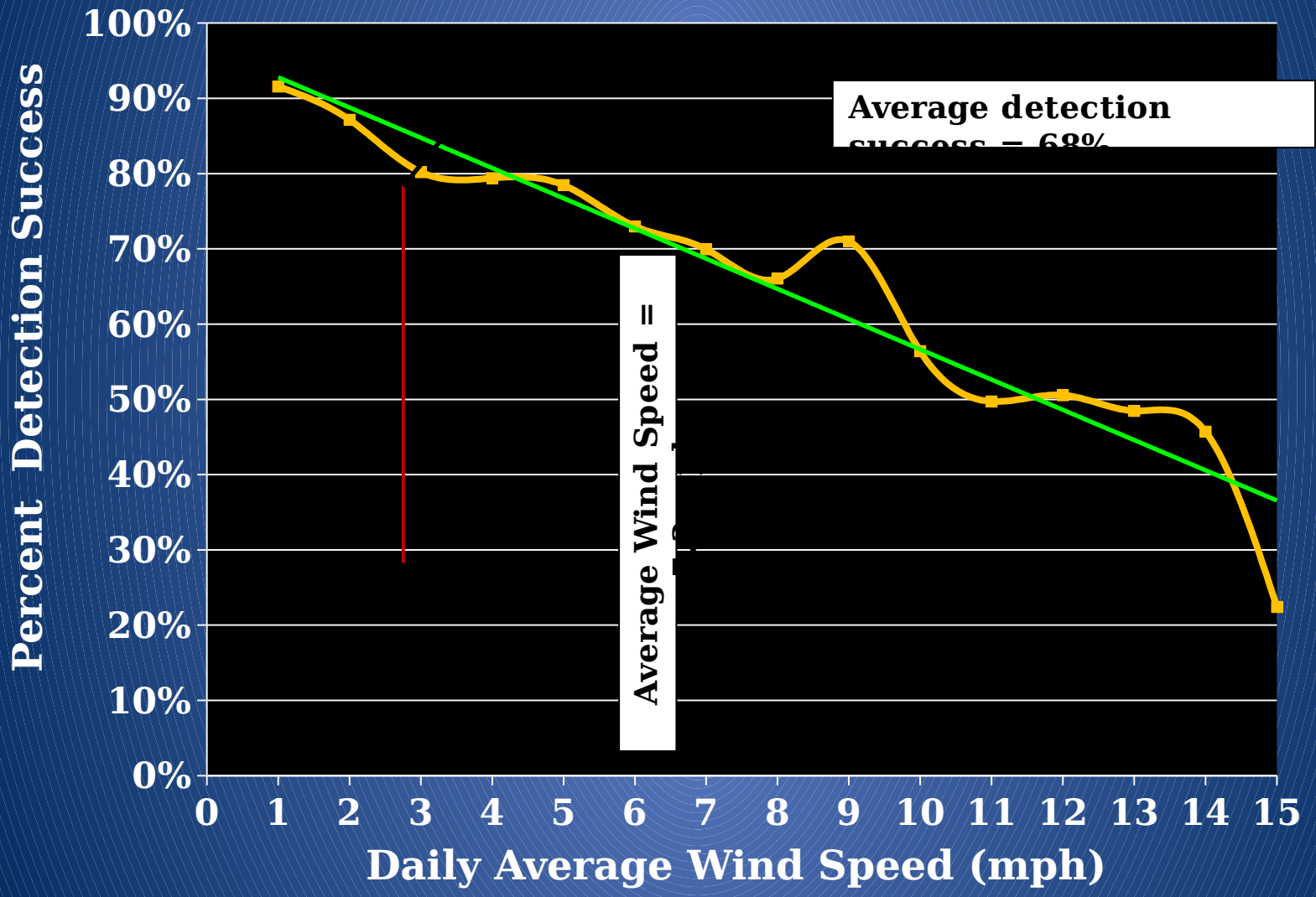
Low wind = Maximum detections

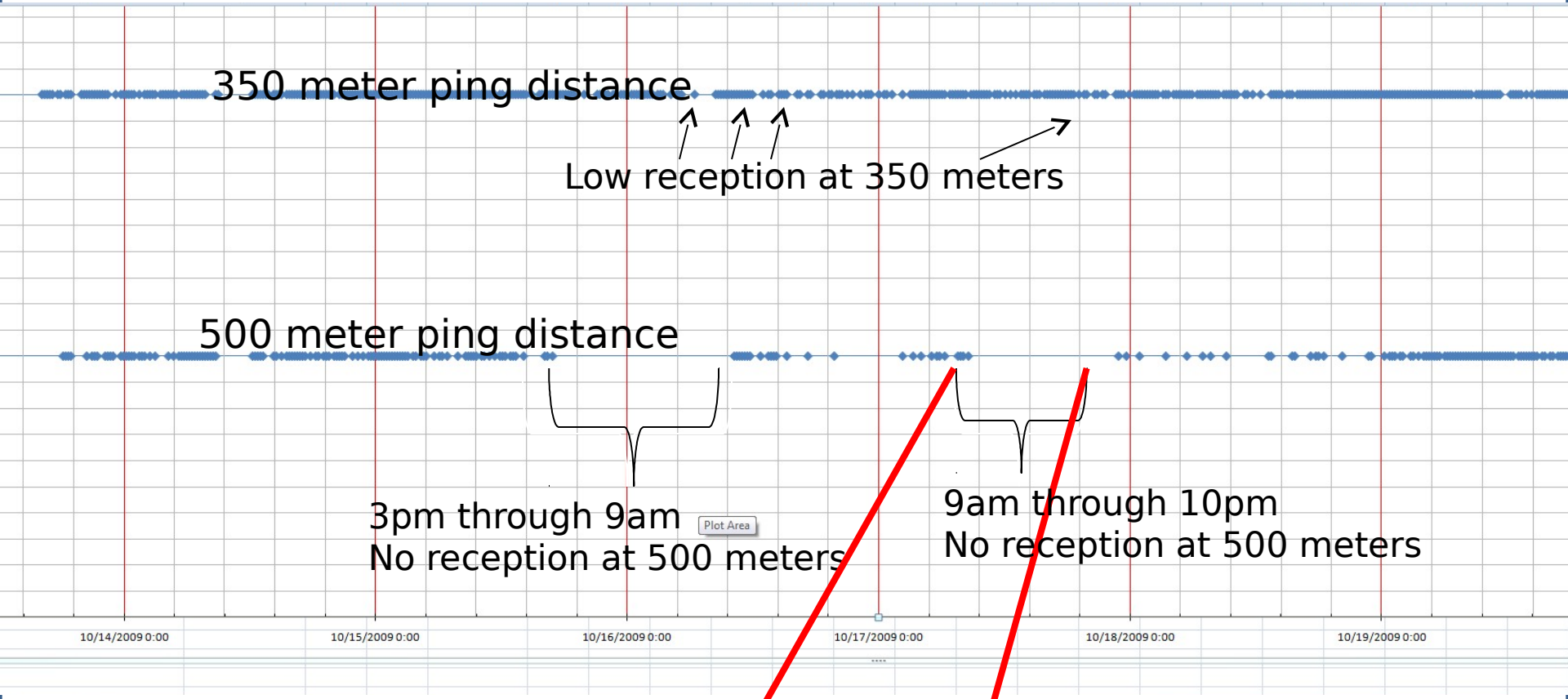
High wind = Lowest detections

DETECTION RATES AND AVERAGE WIND SPEED OVER TWO YEARS

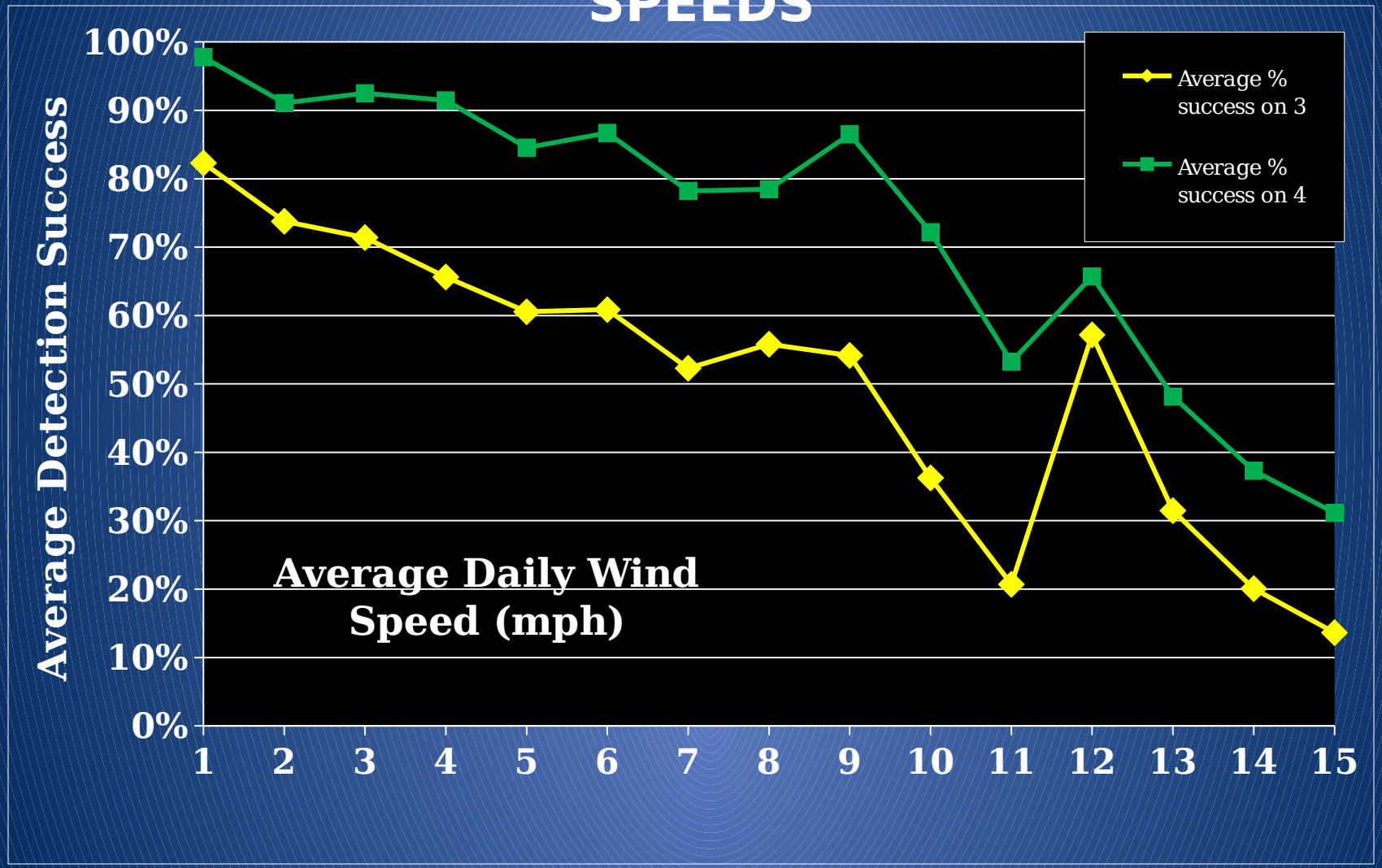
Daily Average Wind Speed (mph)	2009-2010 Average Detections Received	% Detection Success (2009-2010)	2010-2011 Average Detections Received	% Detection Success (2010-2011)	Total Average Detections (2 yrs)	Total % Detection Success (2 yrs)
1	90	94%	86	89%	88	**92%**
2	85	88%	83	86%	84	**87%**
3	80	84%	74	77%	77	**80%**
4	76	79%	77	80%	76	**79%**
5	75	79%	75	78%	75	**78%**
6	76	79%	64	67%	70	**73%**
7	69	72%	65	68%	67	**70%**
8	70	73%	56	59%	63	**66%**
9	78	81%	58	61%	68	**71%**
10	51	53%	57	60%	54	**56%**
11	43	44%	53	55%	48	**50%**
12	69	71%	29	30%	49	**51%**
13	44	46%	49	51%	47	**48%**
14	55	57%	33	34%	44	**46%**
15	43	45%	0	0%	22	**22%**

% DETECTION VS. WIND SPEED




350 meter ping distance
Low reception at 350 meters
500 meter ping distance
3pm through 9am
No reception at 500 meters
9am through 10pm
No reception at 500 meters
Plot Area
10/14/2009 0:00
10/15/2009 0:00
10/16/2009 0:00
10/17/2009 0:00
10/18/2009 0:00
10/19/2009 0:00

AVERAGE DETECTION SUCCESS ON RECEIVER 3 VS. RECEIVER 4 OVER GIVEN AVERAGE DAILY WIND SPEEDS



Receiver 3 was deployed 500 m from test pinger.

Receiver 4 was deployed 350 m from test pinger.

CONCLUSIONS

- Significantly improved Eglin's mission capabilities in defining seasonality of Gulf sturgeon occurrence to prevent impacts during military activities
- Expanded knowledge of Gulf sturgeon occurrence and movement patterns in areas not previously studied
- Movement and distribution patterns of sturgeon from different river systems have been documented
- Performance of acoustic technology in a harsh marine environment was tested and quantified

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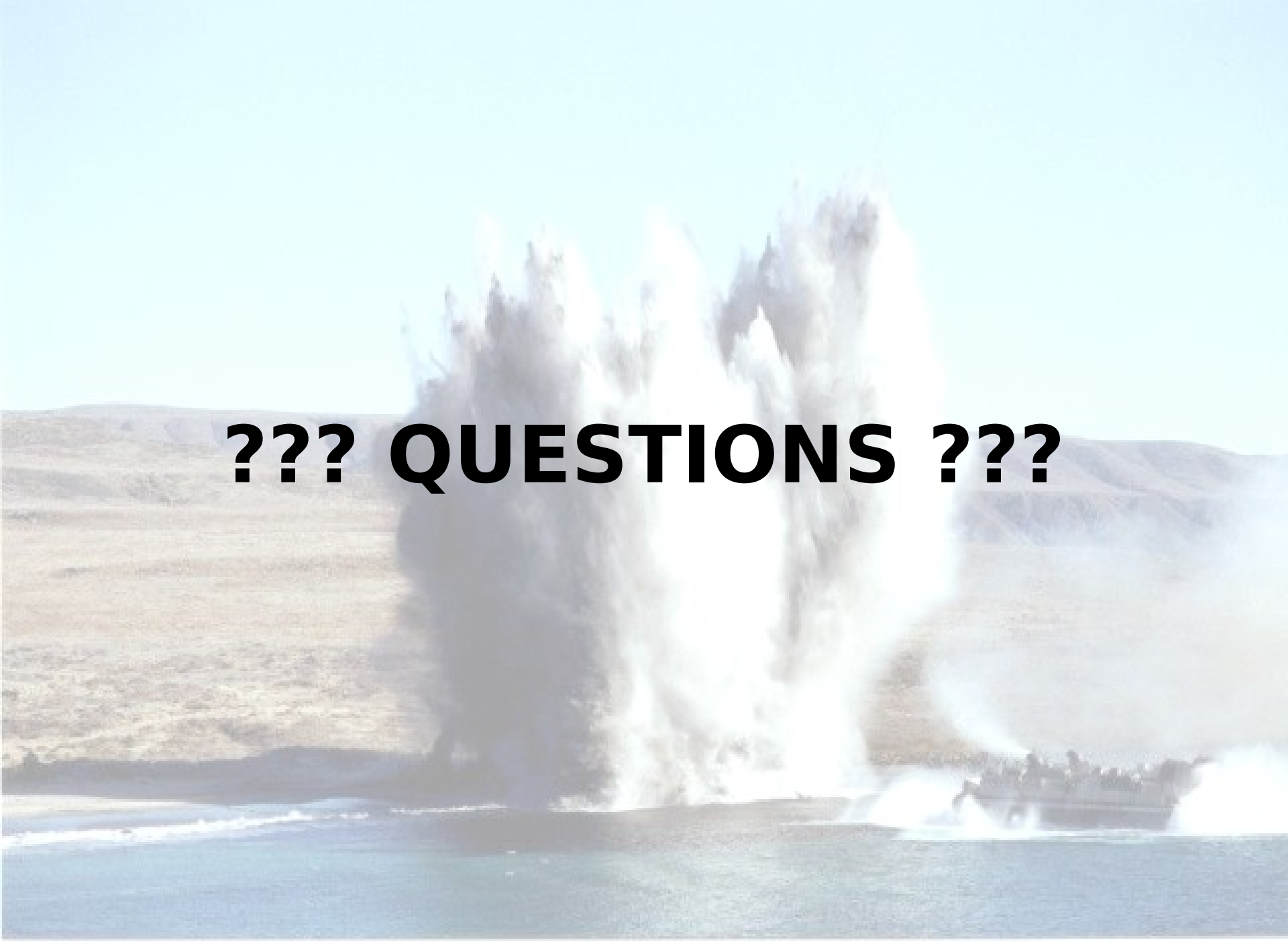
- Frank Parauka – U.S. Fish and Wildlife Service
- Glenn Constant – U.S. Fish and Wildlife Service
- Dewayne Fox and Kate Fleming – Delaware State University


??? QUESTIONS ???